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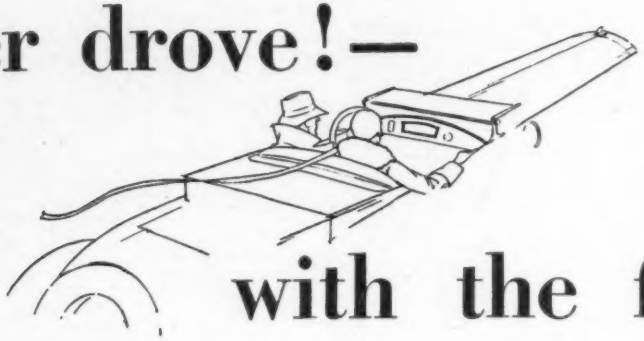

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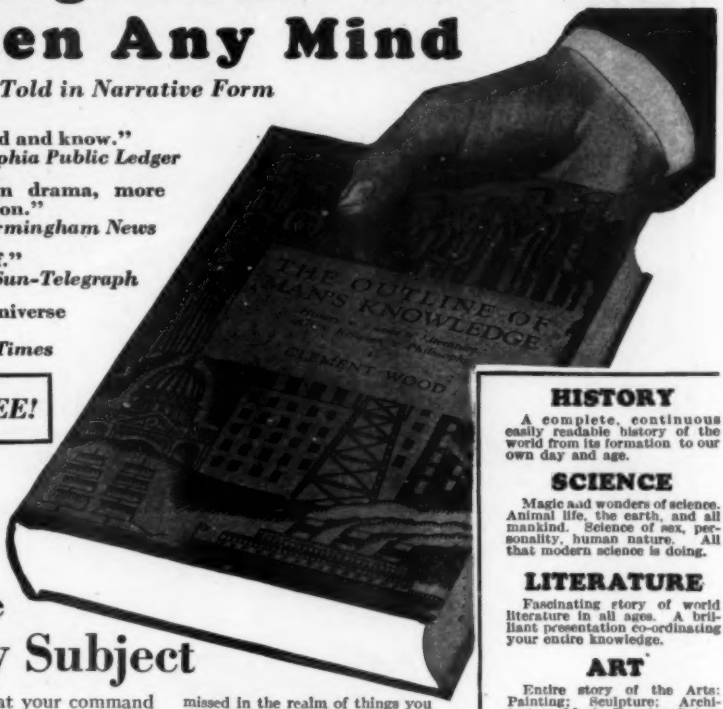

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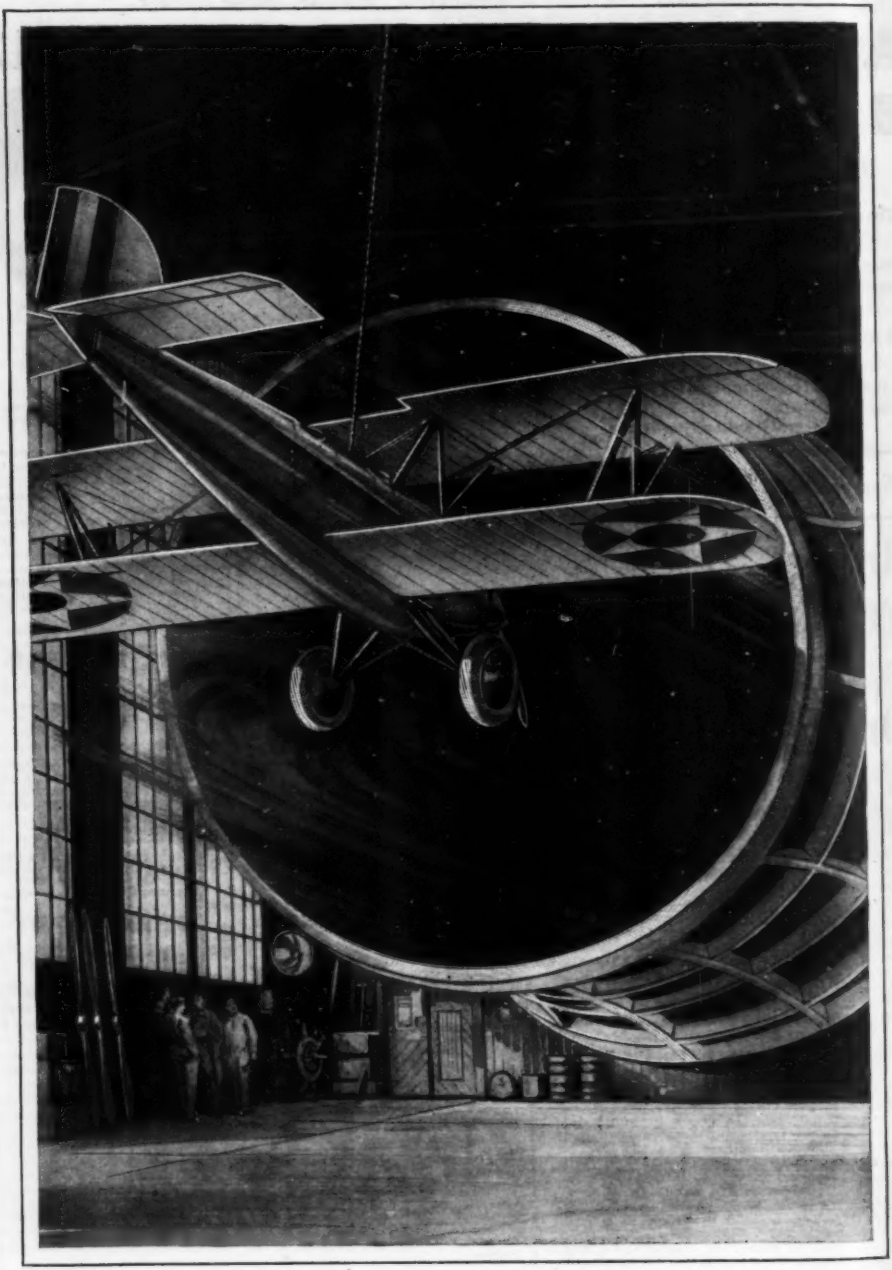

Full-Size Airplanes, Instead of Scale Models, May Be Tested at the Giant Wind Tunnel of the National Advisory Committee for Aeronautics, Langley Field, Va.**—See Page 635**

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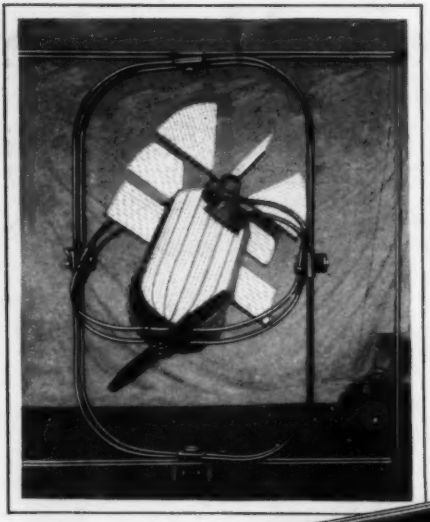
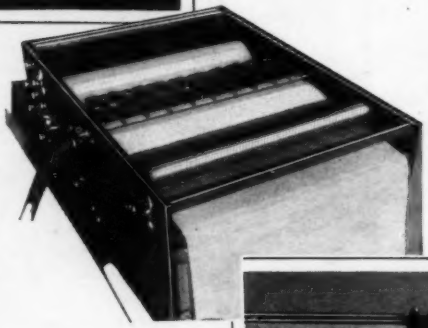
The New Flying Bath Tub

A QUEER-looking device holds the spotlight at the army air corps' experimental laboratories at Wright field, Dayton, Ohio. For lack of a better name it has been called the "flying bathtub," since some of the airmen compare it to a winged variety of the household article.

The new invention, upon which Lieut. Albert I. Hegenberger, among others, has been working for over a year, was designed to take the place of what has been known as one of the most curious devices man has invented in his efforts to rival the birds of the air—the Ruggles orientator—which, placed upon the ground, is intended to give the student flyer the "feel" of a plane long before he attempts to maneuver a ship aloft.

Made from the cockpit of a plane, it is suspended in three concentric rings. With increasing speed, the instructor, from his chair below, manipulates the plane into the desired upside-down or sideways position. Immediately thereafter, it is the student's job to maneuver the machine back again to normal. The judgment with which he does so determines in large part the rating he receives, or rather has received, since the device is now virtually obsolete.





The flying bathtub, or "primer plane" as some call it, is similar in size to the Ruggles apparatus, but the new device goes many steps beyond it. The tub contains both a propeller and an engine, and can therefore simulate to an amazing degree every one of the main maneuvers a real plane can execute.

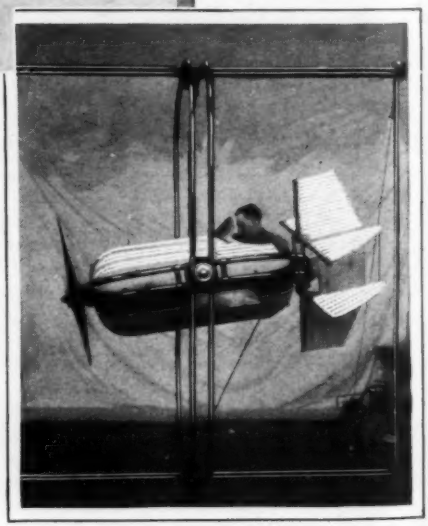
It consists of a small fuselage body with rudder, elevator and aileron, or movable flat foil that serves to keep the ship from wobbling from side to side. These surfaces are fully controlled by the operation of standard airplane apparatus installed in the fuselage body, and the plane itself is sent flying by means of a tractor propeller driven by a fifteen-horsepower electric motor, mounted forward in the fuselage of the bathtub in the same fashion as is the engine in the actual airplane.

The plane itself is mounted in a double-tripod frame, twenty feet high, this height offering a sense of disassociation from the ground besides a certain amount of horizon perspective. While the student becomes familiar with the features of flying that at first are apt to be confusing—the blast of air, the noise of the propeller and the rocking, tipping motions of flight—he also is becoming used to the response of actual flying controls.

With his feet on the rudder bar and control stick in hand, the student flyer can cause the primer plane to assume any position a plane can take in actual flight and gain the feel of the controls and the different movements of the ship with the assurance of safety while he is learning. An instrument board, equipped with compass, clock, air-speed indicator, inclinometer, bank-and-turn indicator, and the rest of the standard flight instruments, enables him to form the habit of automatic reference to the board in all attitudes of flight.

It is pointed out that, from the instructor's point of view, the device will be extremely helpful. He will be able to observe closely the student's reactions, and his natural adaptability to flying. If he notes some fault in manipulation of controls or wishes to demonstrate a certain point, then he may stop the plane at any time and give the student advice.

Then again, by



A Steep Left Spiral, Top, and a Glide, Bottom; in the Center, the Nine Pens of the Poppen Recorder, Which Automatically Charts the Results

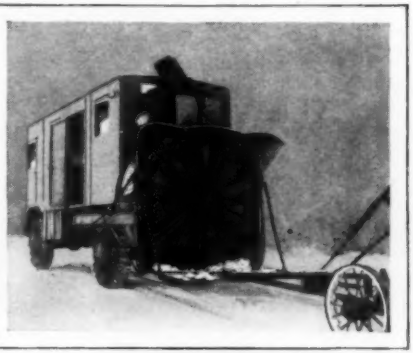
placing a hood over the student's head, shutting off the horizon, sky and ground, blind flying may be taught by the process of having the student attempt to regain, from various attitudes, normal position by simply referring to his instruments.

MOUNTAIN RANGES UNDER SEA FOUND BY ECHOES

Echoes have just aided in two important marine discoveries that may help explain an ocean mystery, the origin of the Humboldt current. By firing detonating shells from a twenty-foot brass shotgun and determining the time the echoes took to return from the floor of the sea, scientists on board the non-magnetic yacht "Carnegie" have found two new ranges of mountains under the ocean. One is more than a mile high above the sea floor and 100 miles off the coast of Ecuador. The other rises to a height of 9,750 feet and runs northwest and southeast, 400 miles to the north of Juan Fernandez island. It is believed that this range may be a contributing cause to the Humboldt current and may also be a remnant of the sunken lands whence sprang the mysterious Easter Island civilization.

ROTARY PLOW ON MOTOR TRUCK KEEPS SNOW FROM ROADS

Roads around Leadville, Colo., were kept free from snow last winter by means of a rotary plow at the head of a ten-ton, four-wheel-drive motor truck. The blades of the plow were so adjusted that the snow was drawn inward and forced out through an inclined spout at the top. The truck is steered from either end, has a sheltered place for the two operators, with a small coal-burning stove to furnish heat, and when there is no snow, is used for hauling road graders and other highway units.



Motor Truck with Rotary Plow That Has Kept Colorado Roads Free of Snow

Model Plane with Double Propeller That Is Expected to Increase Power and Give Steadier Flight

TWIN PROPELLERS ADD POWER AND STEADY PLANE

Increased power for the airplane and steadier flying are said to be achieved with a double propeller which has been demonstrated in a small model. The two are placed within a few inches of each other and, in operation, are reported to produce a gyroscopic effect. Slots in the hubs permit changing the pitch of the blades.

TON WOULD GO IN A MATCH BOX ON DISTANT STAR

So dense is the material on a companion star of Sirius that a match box full of it would weigh a ton. It is 6,000 times as dense as water. This is one of the interesting facts revealed by the new telescopes. The 100-inch reflector at Mt. Wilson observatory is to be surpassed in a few years, it has been announced, by one with a 200-inch mirror and a tube probably not less than eighty feet in length.

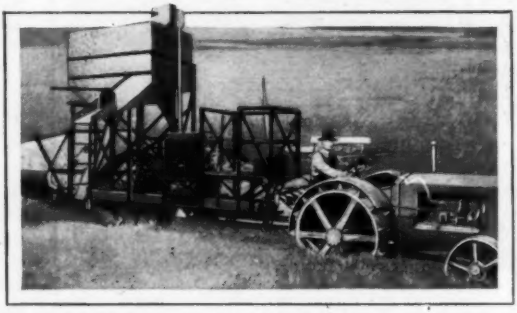
Buoy on Swimmer's Back Contains a Line and Floats, Should Wearer Sink, to Aid in Rescuing Him

BUOY WORN BY SWIMMER AIDS IN RESCUES

So that life-savers quickly may be able to locate swimmers who have become submerged, a small aluminum float, which remains on the surface when the body sinks, has been introduced. It is attached by strong fishing line and is so arranged that it is released and the line unwound as the wearer sinks. The buoy is painted a brilliant color to increase its visibility, and the line can be used to pull the body up.

HARVESTER FOR SMALL FARM CUTS REAPING COST

Harvesters that cut and thresh grain in one operation, until recently, have been practical only on large farms. Now, an outfit suitable for the small grower has been introduced which enables him to cut and thresh an acre of grain in less than twenty-five minutes and at an average cost of less than fifty cents an acre. The machine is pulled by a tractor and operated by a gasoline motor. It is compactly and solidly built, the grain being collected in a large bin at the top, from which it can be sacked or dumped in wagons. On larger farms, two or more of these outfits can be used at one time. The average farm tractor is able to pull two of them.

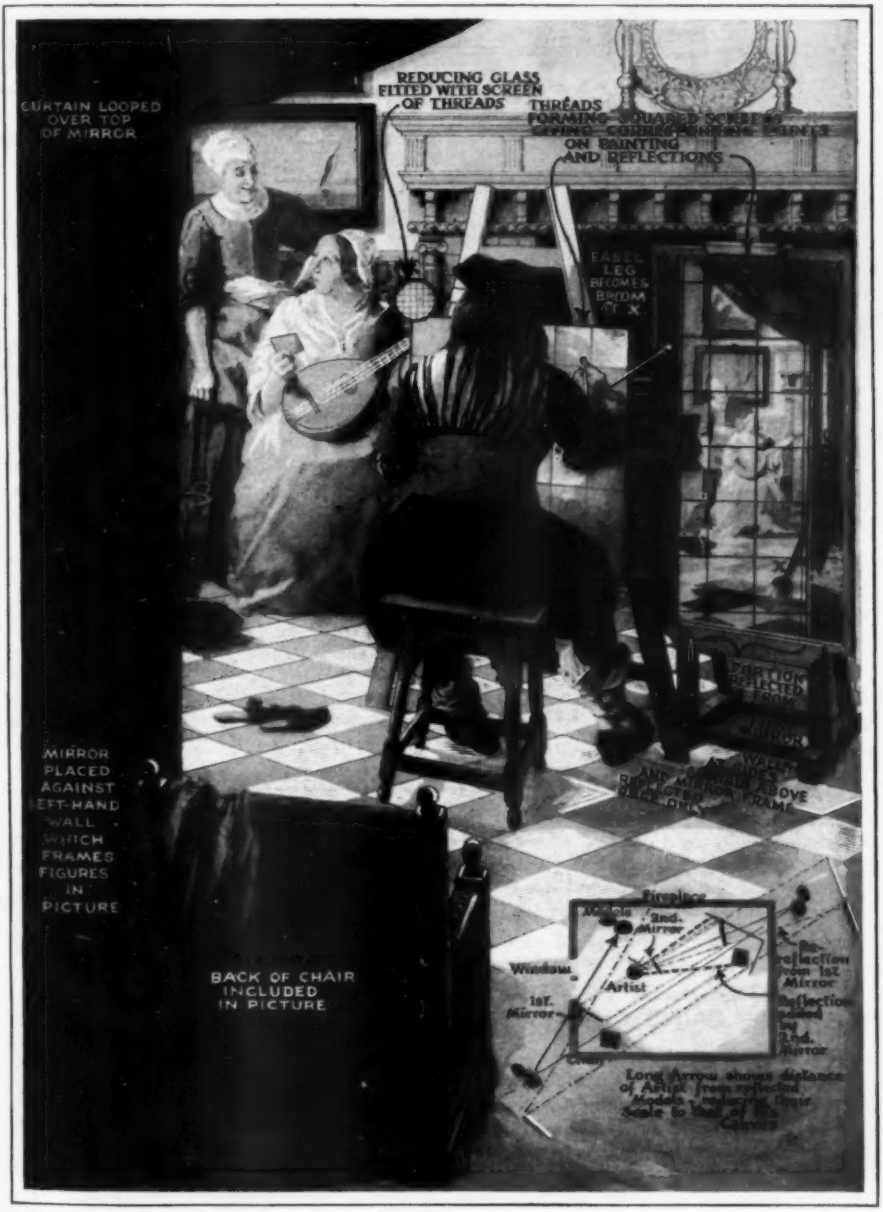


Harvester-Thresher for the Smaller Grain Grower; It Cuts and Threshes an Acre in About Half an Hour

EXPERT BELIEVES OLD MASTER WORKED FROM REFLECTION

Study of the work of old Dutch painters, including Vermeer, of Delft, who lived between 1632 and 1675, has convinced Mr. R. H. Wilenski, a noted English expert, that they worked, at least in some instances, from reflections in mirrors. One of Vermeer's paintings, "The Love Letter," which hangs in the Rijks Museum, Amsterdam, has been supposed to be a picture of two models as seen through a doorway. Wilenski, however, points out that there is no sign of door and frame, and certain peculiarities of perspective in the chair on the right and the wall on the left indicate it may have been made from a reflected image. A diagram on the opposite page shows how such a picture could be painted. With such an arrangement Vermeer could paint a composite picture of the two models, and of objects which were placed behind him. The arrangement of the two reflecting mirrors would permit the artist to compose a picture in one plane before actually starting to paint, by merely moving the objects about until a suitable composition was found. A reducing glass fitted with cross threads also would allow him to automatically scale the proportions. Gerard Dore used such a device. Vermeer's work is noted for the smoothness of his technique and the transparent shadows which would result from reflection of interfering light beams.

DID VERMEER PAINT PICTURES BY REFLECTION?


CURTAIN LOOPED OVER TOP OF MIRROR
REDUCING GLASS FITTED WITH SCREEN OF THREADS
THREADS FORMING QUARED SCREEN
ON PAINTING AND REFLECTIONS
EASEL LEG BECOMES BROOM AT X
MIRROR PLACED AGAINST LEFT-HAND WALL WHICH FRAMES FIGURES IN PICTURE
BACK OF CHAIR INCLUDED IN PICTURE
Fireplace
2nd. Mirror
Window
Artist
1st. Mirror
Chair
Long Arrow shows distance of Artist from reflected Models reduced to their Scale to Width of His Canvas

© S. W. Clatworthy

Sketch, Showing How Noted Dutch Artist May Have Produced His Painting "The Love Letter," by Working from an Image Reflected into a Mirror at His Side

Cord Holder as Used When Iron Is in Operation, and Method of Attaching It to the Board

HOLDER FOR IRONING CORD PREVENTS ACCIDENTS

Easily adjusted to almost any position, a flexible support for the cord that supplies the electric iron with current, has been introduced to help lengthen the life of the cord and to prevent accidents such as may arise from pulling the iron off the board or damaging the cord when it becomes entangled with other objects. The holder keeps the connection out of the way at all times and, when not in use, folds into a small space.

SCRUBBING EARS TOO HARD MAY CAUSE INJURY

Here is good news for boys who object to the vigorous ear scrubbing their mothers sometimes command. According to New York medical authorities, there is danger in the process, for soapsuds and other foreign substances may be forced into the exterior auditory canal or the skin of the ear may be injured. They point out that the ear is a delicate organ and that nothing should be placed in it in the form of a medicine except under the direction of a physician. A slight injury may develop into serious trouble, they say. In washing children's ears great care should be exercised. A soft cloth should be used for the operation. Another danger lies in blowing the nose too vigorously, because secretions may be carried into the middle ear, resulting in an infection.

METAL COATING ON FABRICS TO AID AVIATION

Lighter and stronger airplanes are seen as a possibility in the development of a process for coating paper, silk, wood and other materials with metal by an electrochemical method. Experts point out that, if the system proves successful, planes with the strength of metal could be made from much lighter materials.

CHURCH IS RAISED ON STILTS FOR FILLING GULCH

So that the gulch in which it was located could be filled to make a level street, a frame church in Los Angeles was recently raised twenty-four feet on a scaffolding. The structure was twenty-four by seventy feet and was elevated without mishap. Dirt was piled in around the timbers and, in a short time, the church again was resting on solid ground.

Where a Church Went Skyward on Stilts; Frame Structure Raised for Filling In, to Make Street Level

PLANE RESCUES WOMEN FROM BESIEGED CITY

Women and children were taken safely from a besieged legation on the Indian frontier recently during a rebel uprising, when armed soldiers in a troop-carrying airplane went to their rescue. Infantrymen, in constant touch with forts by radio, guarded the refugees as they were taken to safety. The plane was of a special army type with a top speed of more than 100 miles an hour and a cruising radius of 400 miles. A group of five such ships can carry 100 soldiers and quickly reach districts where trouble has sprung up.

Courtesy Vickers, Ltd.

Interior and Exterior Views of the Big Transport Airplane Used in Rescuing Women and Children from the Indian Frontier; Twenty Passengers Can Ride in One Plane

MORE USES FOR WOOD NEEDED TO REDUCE WASTE

To effect greater conservation, there should be more uses for wood, according to Dr. Julius Klein, of the department of commerce. He explains that a more efficient utilization of the material would make it more profitable for growers to plant and raise trees. At the present time, only the choicest parts of the tree are used and most of the rest is wasted or at least not used to best advantage. Chemical processing of wood, the manufacture of plywood and end-matching of lumber are among the methods that have been developed along the line of more thorough utilization. Doctor Klein urges consumers to buy more short lumber whenever possible. Large quantities of lumber in this form are burned up each year because the mills cannot sell it. A further saving is realized in end-matched flooring. End-matched joints meet anywhere, on or between the joists or other supports so that less cutting is necessary. Development of processes for obtaining valuable by-products from wood, such as synthetic camphor, artificial silk and wood alcohol will also promote conservation and encourage tree raising, Doctor Klein points out.

Einstein's Latest

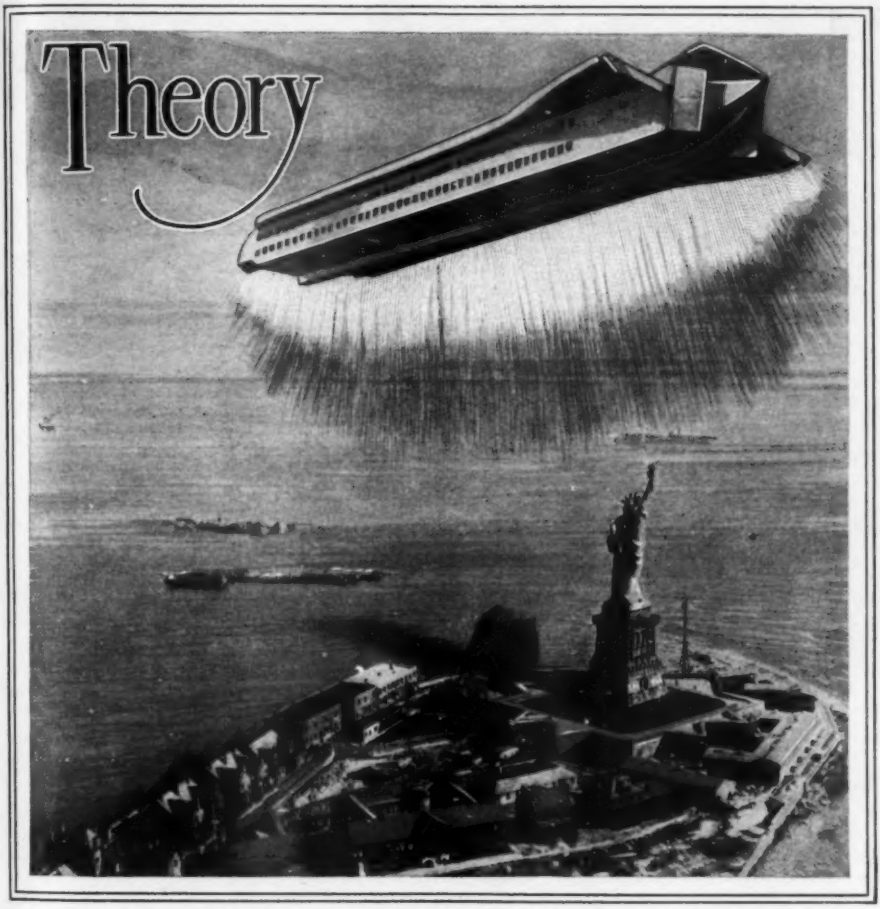
Floating in Air, Restrained Only by Celluloid Guides, the Cobalt-Steel Magnet Bar Conquers Gravity through Magnetic Repulsion

A NEW form of geometry, providing equations which may furnish proof that there is only one substance in the universe, has been developed by Prof. Albert Einstein. Fitting in between the Euclidean geometry, familiar to every school boy, and the Riemannian geometry used by Dr. Einstein in working out his famous theory of relativity, the new mathematical laws which he now proposes go a long step farther in extending the natural results of relativity.

For his new equations are based on the assumption that gravitation and electricity are the same thing. That heat and light are related was discovered early in the history of mankind. That heat and energy were related was discovered next—a discovery that was for a long time doubted, though now every form of engine is based on it. One by one science proved the interrelation of light, heat, energy, matter, space, time, gravitation and electricity, until only one factor was left—the specific relationship of the last two. And, if the new Einstein equations stand the test of scientists, it will be proved they are the same thing.

The new geometry, while it seeks to reduce all physics to one law, leaves one problem to be solved, and its success probably depends on further development to bring the theory of atoms within its scope. Doctor Einstein took a step in that direction in 1927 in two papers in which he attempted to define the laws of motion of atomic particles in the gravitational field. When the theory of relativity was announced it was stated not more than twelve men in all the world were sufficiently educated in higher mathematics to fully interpret it. Like its predecessor, the new theory—six brief pages representing ten years' work—is full of equations that only a few scientists will be able to interpret.

But, while the theory itself is almost incomprehensible to the layman, it opens a field for fascinating speculation. Since it is possible now to insulate against electricity, it follows that, if electromagnetism and gravitation are the same thing, it may be possible some day to insulate against gravity. If that ever comes to pass, motorless aircraft may ride the skies, people may step out of skyscraper windows without falling to the ground, and a trip to the moon becomes theoretically

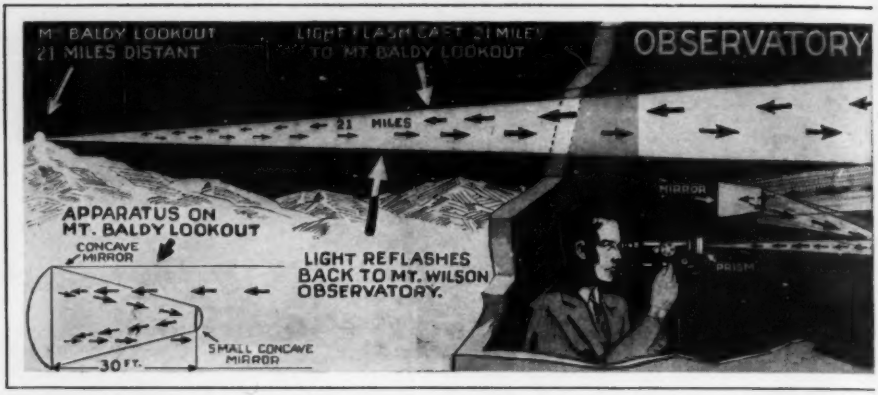


Is This the Airship of the Future? A Motorless Craft Flying through Space because Insulated against Gravity; Einstein's New Theory Opens This Field to Speculation

possible. Those are some of the avenues of speculation suggested by Dr. H. H. Sledon, head of the department of physics at New York University.

Since Newton first proposed the law of gravity—based, according to the story, which probably is not true, on the falling of an apple which struck him while he slept beneath the tree—science has been seeking some way of upsetting that natural law. The gravitational theory, as it was developed, assigned all movement in the universe to the attraction of masses. The planets were held in their courses by the attraction of the sun, and their orbits were made to deviate from a circular path by the mutual attraction between them.

Then Einstein developed the theory, which is now elaborated, that instead of each body, through its mass, causing everywhere in space a certain effect known as gravitation, the latter effect manifests itself only in the immediate surroundings of the body in its gravitational field or area. That, according to Dr. Bruno Borchardt, of the Prussian Academy of Science, was the chief development of the theory of relativity. According to this theory, he says, "each body with its gravitational area acts on space in such manner as to shape or reshape it. In other words, space can no longer, as before, be



Einstein's Work Has Been Closely Connected, Since the Original Theory of Relativity, with the Measurement of the Speed of Light by Prof. A. A Michelson, of Chicago University

considered as something absolute, such as time used to be regarded by us."

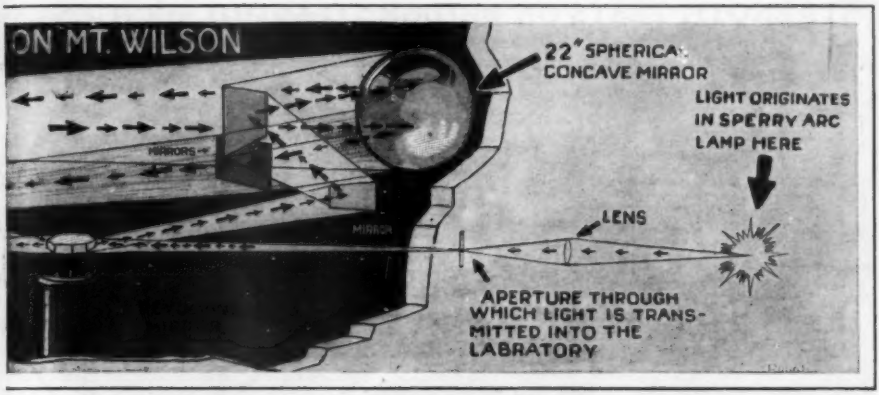
The confirmation of this theory left two general problems unsolved, according to Dr. L. L. Whythe, the British physicist. The first was its extension to include the phenomena of electromagnetism, and the second was the correlation of a continuous "space-time field" with the facts of the atom theory. Doctor Einstein's latest achievement probably is the best fusion of electromagnetism and gravitation that can be accomplished without considering atomicity, he adds. Eventually it may be necessary to invent still another system of mathematics to take the atoms into the fold and finally reduce all physics to a single law. Recent theoretical advances in atomic physics may make this possible within a short time.

Science has known for a long time that the repulsive force of magnetism when two magnets were placed parallel was theoretically great enough to overcome gravity, provided magnets of sufficient strength could be used. Recently engineers of the Bell Telephone laboratories and the Western Electric company—the manufacturing unit of the Bell system—found that a cobalt-steel alloy, invented some years ago by a Japanese metallurgist and now widely used in telephone parts, had magnetic strength to do just this.

When one of the bar magnets made from this alloy is placed above a similar bar, and constrained by guides to that position, the repulsive force is so great that one bar will be kept floating in the air, unsupported by any visible force. The repulsive force exerted between the two magnets is practically equal to the gravitational force on a single magnet, so that one overcomes gravity. As the repulsive force varies inversely as the square of the distance, it is possible to calculate the magnet strength needed to support a given weight at any given distance.

Announcement of this experiment was confused in the public mind with the use of permalloy, a new magnetic alloy made of nickel and iron, and used as a winding around the copper core of recent transatlantic telegraph cables. Neither of the magnets used in the floating-bar experiment is of permalloy, and, in fact, the two materials have exactly opposite characteristics. The cobalt-steel is used for the magnet bars because it will hold a very high magnetizing charge. The permalloy, on the other hand, gets its name from the fact that, after a specially invented heat treatment, it develops high initial permeability, that is, remarkable capability of being magnetized by very weak forces, while for strong magnetizing forces it is not as good as plain iron.

Weak magnetizing forces are commonly met in all forms of communication, wire, radio and submarine. The first use of the new permalloy, therefore, was as a winding for submarine-telegraph cable. Several such cables have been "loaded" by this method with permalloy tape, and, by virtue of the higher inductance they offer



The Michelson Experiments Were Checked Again This Winter with This Apparatus, Installed on Mt. Wilson and Mt. Baldy, Two California Peaks Twenty-One Miles Apart

to the weak telegraphic currents, thus offsetting the capacity from cable conductor to the sheath or sea water, they permit the transmission of a wider range of signal frequencies, and hence a higher speed of telegraph operation. Such cables have about five times the message capacity of the old-style cable. The permalloy also is being used to a wide extent for parts of new telephones and telephone apparatus, wherever its properties prove useful.

Because magnetism, as represented by the deflection of the compass needle, is manifest everywhere on the earth, the idea of harnessing the earth's magnetic currents is one that has been proposed for centuries. One of the oldest forms of perpetual-motion scheme proposed an incline up which a ball weight should be drawn by a magnet placed at the top. Just before the ball reached the magnet it was to fall through a trap, roll down a second incline, and return to the starting point, to repeat the performance. As far back as 1579, Bishop Wilkins described such a device in his book "Mathematical Magick," along with several others, all designed to utilize the earth's magnetic force.

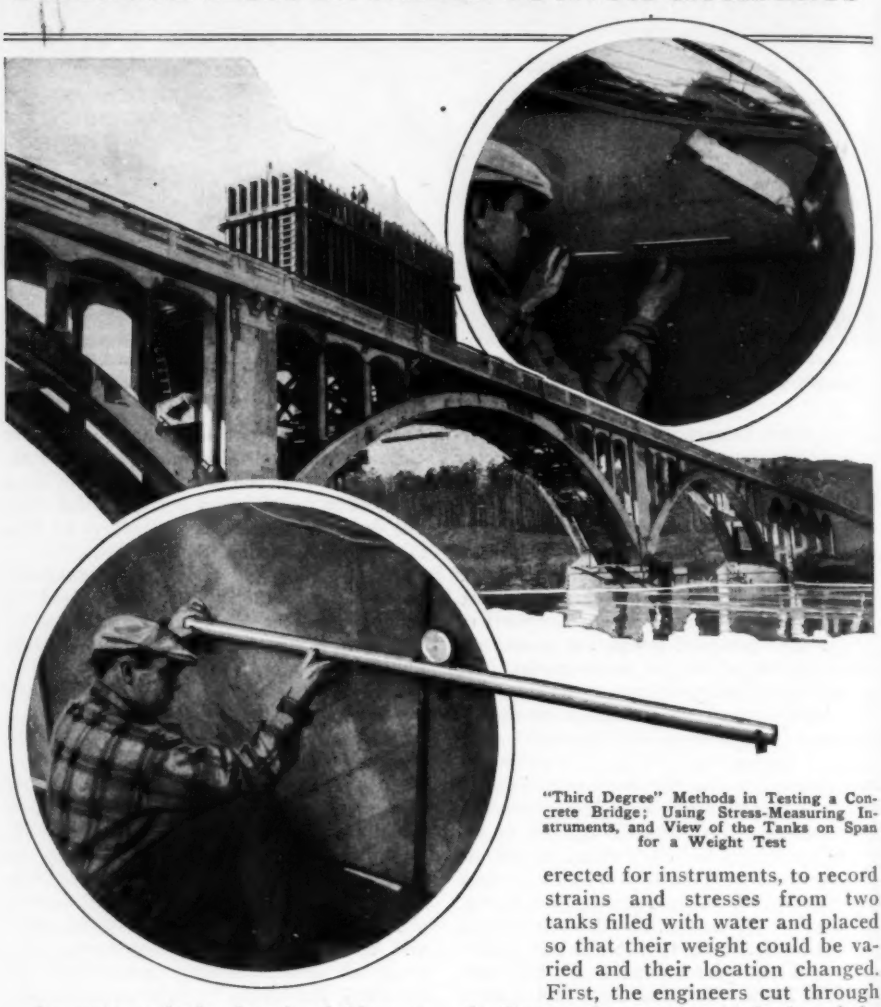
Science discovered long ago that that force isn't strong enough to be utilized for anything much harder than turning a well-balanced compass needle, though, as recently as a year ago, two prominent flyers were reported to be interested in a so-called "magnetic motor" which was supposed to turn magnetic forces into power. Another suggestion offered to the war department not long ago was that the nose of an aerial bomb should be magnetized so that the attraction of the mass of steel in an enemy warship would draw the bomb to the mark regardless of how it might be aimed when dropped.

As the most powerful electromagnets made have a lifting radius limited to inches, the idea of using magnetism, so far as it is now understood, is certainly impractical.

The Einsten theory, however, if it can be developed some day into a workable formula, may revolutionize all present-day accepted notions of what is possible. Radio, to begin with, was merely a scientific theory. The atomic theory itself was only an interesting speculation to begin with, but as a result of its classification of the ninety-two elements which it provides for, several of the unknown ones, such as illinium and niobium, have been discovered, and, in fact, only two of the ninety-two, both of them probably somewhat radioactive chemicals, remain to be found.

The atomic theory is closely linked with Einstein's theory of only one substance in all the universe, for it is based on the assumption that the only difference between the known elements lies in the number of electrons revolving around the proton which forms the center of each atom of the material. In other words, the atom is a little universe somewhat like our own, with a proton in the center in place of a sun, and electrons revolving around it in place of planets.

STRENGTH TESTS ON BRIDGE TO AVOID ACCIDENTS



"Third Degree" Methods in Testing a Concrete Bridge; Using Stress-Measuring Instruments, and View of the Tanks on Span for a Weight Test

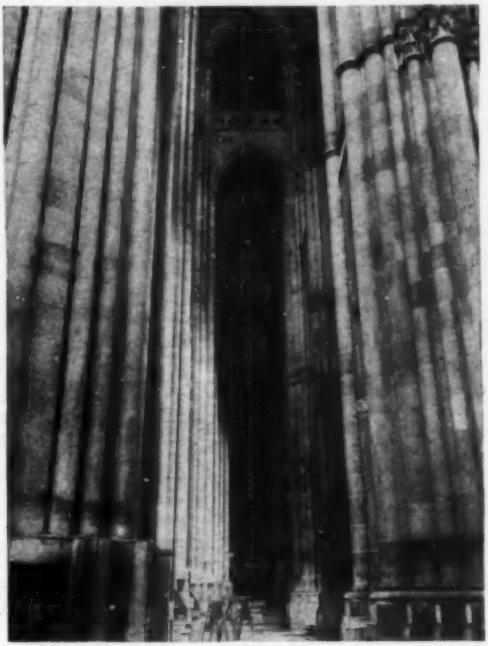
Accurate methods of testing bridges, to discover those that are unsafe, were demonstrated recently by engineers of the bureau of public roads who used special instruments in determining the strength and capacity of the Yadkin river bridge in North Carolina. The structure is a quarter of a mile long, has seventeen spans, three of which are 146 feet in length, and had been abandoned because of the building of a dam in the river. Under the arch of one of the longest spans, a scaffolding was erected for instruments, to record strains and stresses from two tanks filled with water and placed so that their weight could be varied and their location changed. First, the engineers cut through the floor to destroy the continuity of the concrete slab for a test of its strength. Next, various instruments were placed so as to record the amount of strain and to give data as to just how much the concrete span varied under the weight of the tanks. A clinometer was used to measure the change in the position of the arch rib. This instrument is similar to a carpenters' level. Changes in the length of the rib were measured with an instrument electrically connected to a central station

where the readings were made. By means of storage batteries, the instruments gave automatic records. Electrical methods were also used to gauge the change in the position of the arch rib. The bridge did not collapse under the heaviest load, but cracks developed which showed that it was unsafe.

PARACHUTE HAS METAL RIBS TO AID IN LANDING

Several interesting features are combined in a marine parachute which has been devised and tested by a Chicago man. It is attached to the side of the plane, is released by pulling a cord and is connected by a strong rigging to a sling harness which the aviator wears instead of the usual parachute bundle. At the instant of release, the parachute opens quickly somewhat like an umbrella. It has twelve ribs of a strong, light metal and is so adjusted that it will not capsize and will remain afloat and open even if the jumper should alight on water, thus serving as a raft. The rig can be quickly closed up again for another jump, weighs less than twenty-five pounds and is so arranged that it is released from a plane flying at any angle.

Parachute as It Is Carried on Side of Fuselage; It Is Fastened to Pilot by Line and Opens When Released

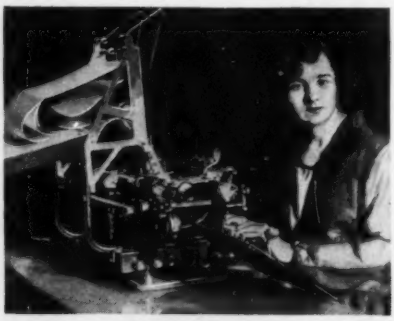


View of the Nave of the Cathedral of St. John the Divine, Now under Construction in New York City

HUGE CATHEDRAL IN NEW YORK TO BE THIRD LARGEST

On the basis of ground surface covered, the cathedral of St. John the Divine, now under construction in New York city, will be the third largest place of worship in the world. It will occupy more than 109,000 square feet. In exterior length, it will be second among the world's great churches. One of its most remarkable features is to be the nave which is ninety-six feet wide. The prevailing style of architecture is what is known as thirteenth-century French and was developed by medieval builders who erected the Notre Dame cathedral, and those of Amiens and Rheims. Sculptors and carvers are closely following the designs of the sculptors of old in the details of the decorations.

¶ Whales to the approximate number of 10,000 constitute the annual catch in antarctic waters.



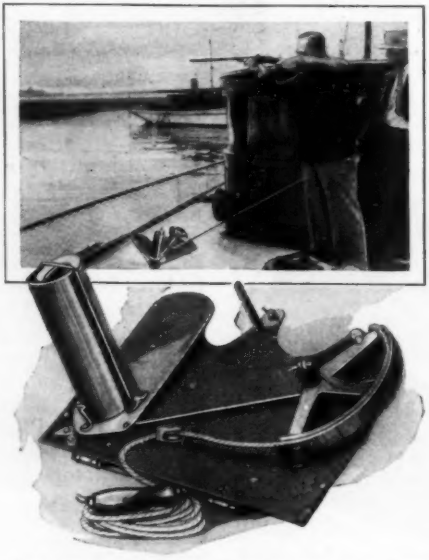
Carbon Inserter Adjusted to the Typewriter; It Saves Handling the Sheets Separately

CARBON ADJUSTER FOR TYPIST SAVES OFFICE TIME

Sheets of carbon are adjusted between papers in typing by a machine which is said to save considerable time and trouble. It is so placed that it does not interfere with the operation of the machine.

PORTABLE TRAP FOR SHOOTING AIDS OUTDOOR SPORT

Pleasures of trapshooting may now be enjoyed almost anywhere with the aid of a portable trap that folds up for easy carrying in motor car, boat or pack saddle. It holds forty-three birds which are fed automatically from the magazine against a spring that hurls them eighty-five to 100 feet at a pull on the release cord. Direction, speed of flight and angle are controlled at will, and the trap is quickly made ready for use simply by unfolding it and anchoring it with a special pin. The trap weighs less than ten pounds and is built to give long service.



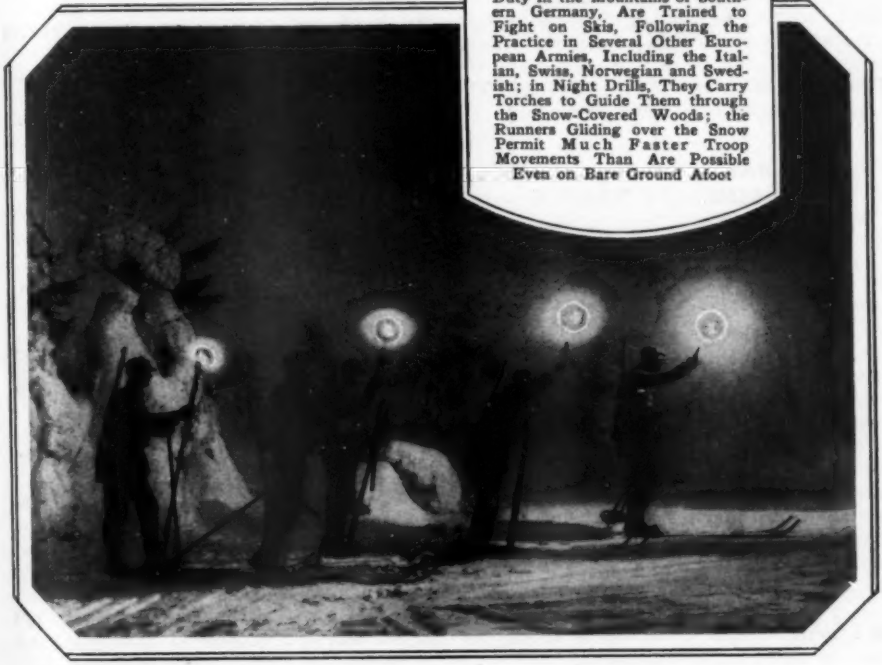
Trap Gun in Use on Board Boat, and Close View, Showing the Magazine and Cord Trip

MINERS HARNESS SURF TO GET GOLD FROM SEA FLOOR

In 1897, when gold was discovered in the sands off Nome, Alaska, there began a long series of interesting attempts at submarine placer mining, for quantities of gold were known to be farther out from the shore. Today, the beach is strewn with the wreckage of the various machines that were used, broken dredge hulls, steam and gasoline engines, and curious scoops that were meant to harvest the golden grains from the tides. The place would be a junkman's paradise, were it not for the facts that the freight rate to market is $30 a ton and that a team of horses rents for $40 a day. However, with pans and surf washers, considerable gold is still being taken from the sands. The surf washer is essentially a short sluice box, so arranged that the surf will wash the sands up into it and the particles of gold are collected by mercury. Sixty miles south of Nome, three miners are operating a development where they have found a pay streak below the line of the surf's wash. In the winter, they dig down through the ice and into the bedrock, thawing the way with steam. Before spring, they dig out all the pay dirt they can and dump it above the line of wash, for later treatment with pans and a surf washer to collect the gold. They have operated this mine from under the ice for thirty years. The plant lies at the foot of the Council mountains, a range where many broken bodies of quartz have been found. When exposed to the frost, these quartz fields become free-milling ore, and for this reason it is possible for the waves to help extract the gold.

TRAINING NEW GERMAN ARMY TO FIGHT ON SKIS

Soldiers in the Reichswehr's Seventh Regiment, Picked for Patrol Duty in the Mountains of Southern Germany, Are Trained to Fight on Skis, Following the Practice in Several Other European Armies, Including the Italian, Swiss, Norwegian and Swedish; in Night Drills, They Carry Torches to Guide Them through the Snow-Covered Woods; the Runners Gliding over the Snow Permit Much Faster Troop Movements Than Are Possible Even on Bare Ground Afoot



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Utilizing the Tides to Build a Bridge; Floating Big Span into Position for Structure across San Francisco Bay

"MOON POWER" IS HARNESSED IN BUILDING BRIDGE

Engineers indirectly utilized the force of attraction from the moon in installing a 303-foot span of the highway bridge over the deep-water channel of San Francisco bay. Taking advantage of the high tide, the span, weighing 613 tons, was towed into place and slowly carried into the proper position as the tides receded. The bridge is more than seven miles long.

JOINT RAIL AND BUS SERVICE TO SIMPLIFY TRAVEL

Joint rail and bus service is planned by the Pennsylvania railroad on the same principle as its combination facilities by trains and airplanes. Passengers will be offered the option of making their journeys partly by rail and partly by bus, using sleeping cars at night and busses for all or part of the journey by day. The service is expected to be extended until, in certain areas, busses may take the place of branch-line trains or others where traffic is light and until through tickets, covering joint rail and bus journeys, will be sold over certain routes. The innovation will promote the efficiency of bus lines as feeders to the rail system, officials predict.

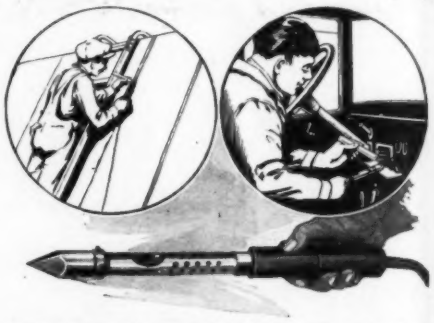
¶Raising rabbits is becoming an important industry in the southwest.

NEEDLE TESTS OIL PAINTINGS FOR FRAUDS

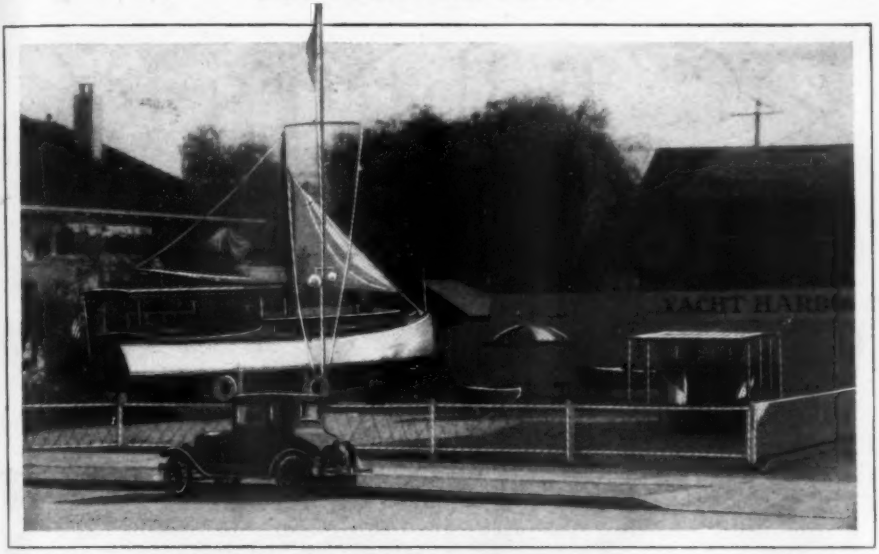
By means of a small hypodermic syringe, an eastern chemist takes samples of paint from old oil paintings for analysis. His research reveals the chemical nature of the samples and thus gives a clue as to the approximate age of the painting and its author, for different artists made the same colors in different ways, and the paints of various ages were of different chemical combinations. The needle of the syringe removes a tiny cylinder of paint without mutilating the subject and enables the examiner to determine the quality of the different layers of paint, an important point when a new subject has been superimposed upon a painting.

ELECTRIC ARC SOLDERING IRON USES LITTLE CURRENT

Economy of current and elimination of the usual wire heating element, are features of an electric-arc soldering iron which has interchangeable tips for many purposes. Only intermittent use of the current is necessary, as heat is rapidly generated through carbons that form an arc at the end of the tool. A thumb control in the handle permits easy regulation.



Typical Uses of the Electric Soldering Iron, and a Close View to Show the Heat Control



Yacht Harbor in City's Residential District Also Serves as Display and Sales Station; Craft in Storage at Los Angeles Yard Where Prospective Customers Can Inspect Boats

INLAND HARBOR FOR YACHTS SERVES AS SALESROOM

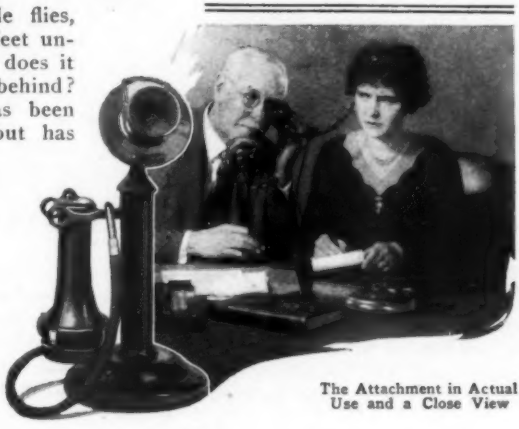
In the midst of the residential section of Los Angeles, is an inland harbor for small yachts and other pleasure craft. Besides providing safe and convenient storage for the boats, the place also serves as a display and salesroom.

EAGLE'S FEET ON COIN RIGHT? WRONG, SCIENTIST SAYS

When an eagle flies, does it tuck its feet under its breast or does it let them trail behind? The question has been asked before, but has come to the front again in considering the eagle design on our silver quarter dollars and twenty-dollar gold pieces. The bird is shown with its feet trailing. According to Capt. C. W. R. Knight, British naturalist, who has taken motion pictures of eagles in flight, this is wrong. He declares that the bird allows its feet to trail only when it is taking off for a flight.

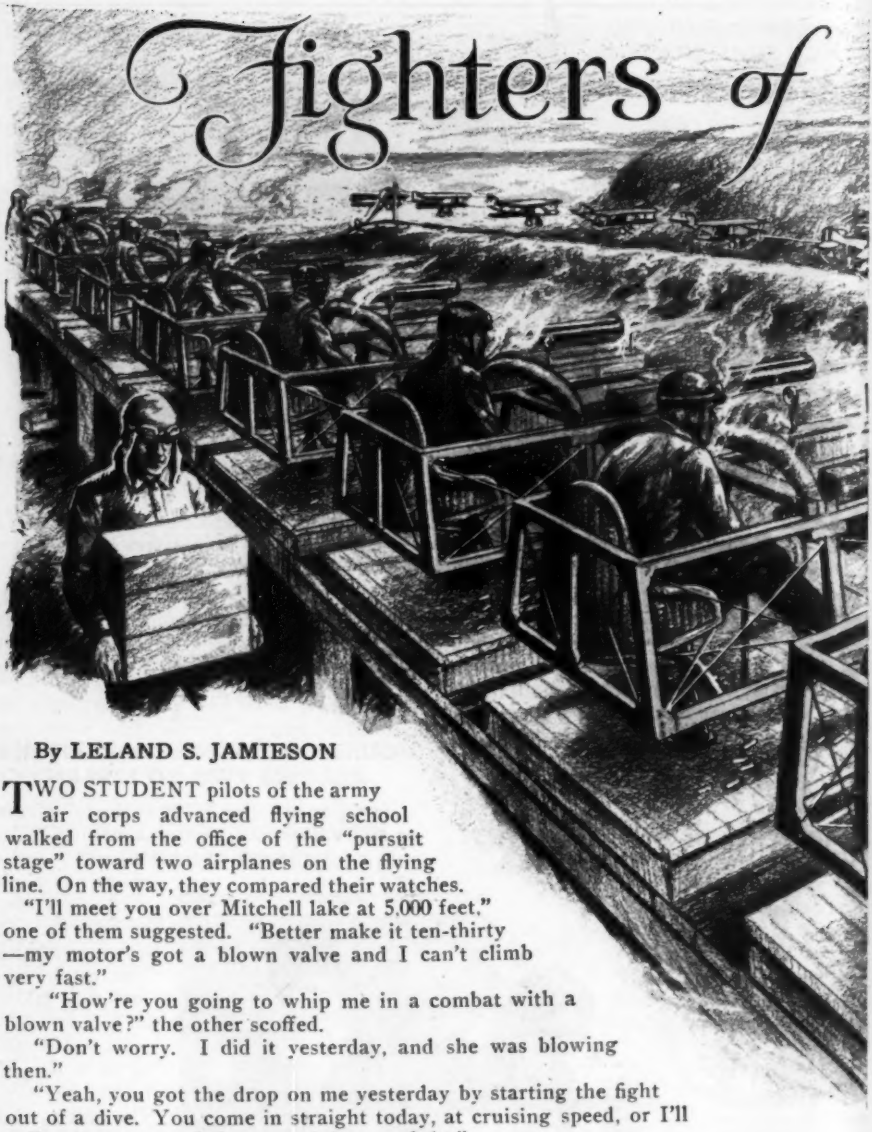
DOUBLE EARPIECE FOR PHONE ALLOWS TWO TO LISTEN

Two persons may listen at the telephone at the same time or one may use both ears with the aid of an earpiece attachment which slips over the receiver. It leaves one hand free, can be adjusted or taken off in a few seconds and is said to be a benefit to the hearing. The unit can be carried in the pocket. Of course only one of the listeners can use transmitter, but this is usually no drawback.



The Attachment in Actual Use and a Close View

Fighters of



By LELAND S. JAMIESON

TWO STUDENT pilots of the army air corps advanced flying school walked from the office of the "pursuit stage" toward two airplanes on the flying line. On the way, they compared their watches.

"I'll meet you over Mitchell lake at 5,000 feet," one of them suggested. "Better make it ten-thirty —my motor's got a blown valve and I can't climb very fast."

"How're you going to whip me in a combat with a blown valve?" the other scoffed.

"Don't worry. I did it yesterday, and she was blowing then."

"Yeah, you got the drop on me yesterday by starting the fight out of a dive. You come in straight today, at cruising speed, or I'll pull out on you and there won't be any fight."

"Five thousand—at ten-thirty. Let's go."

Both men swung into their parachute harness and climbed into the cockpits of their planes. They spent a few moments inspecting the curious-looking black objects which nestled against the cowling in front of the planes' windshields—their camera guns—then waved the blocks away and taxied out into the flying field. Streaking away in front of fan-shaped clouds of dust, they took off and climbed leisurely into the cloud-flecked blue.

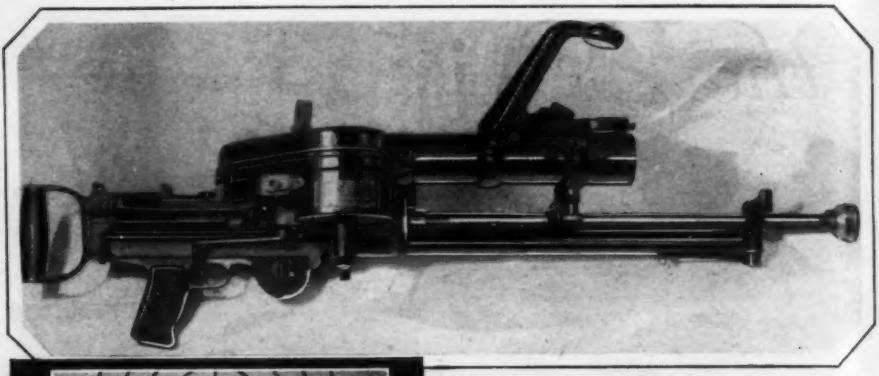
the Air

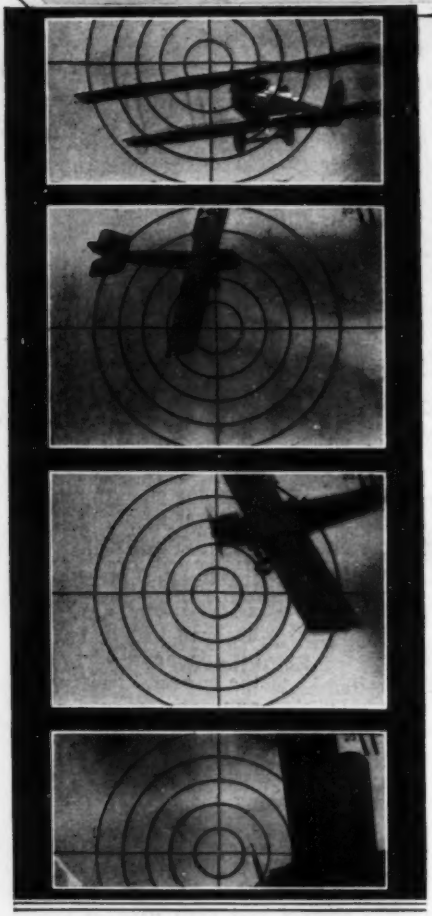
Student Gunners on the Machine-Gun Range at Brooks Field, Tex., Shooting at Moving-Airplane Targets

Ten minutes later, at 5,000 feet, they waved to each other, circled away and separated by a mile or more, then cut sharply and flew almost head-on. Gradually each man eased his throttle forward; each ship picked up speed until it was "spanking" its way through the air at 140 miles an hour. Each pilot gripped the machine-gun control on his stick and squinted along the top of the fuselage at his opponent; the two planes passed each other, and instantly each man eased back on his stick and whipped his plane up and around. The "dog fight" was on.

One ship was superior to the other in climbing ability, and gradually its pilot forced it around until it was upon the other's "tail." Slowly "feeling" his controls to get the maximum performance from his plane, he lined his sights upon his opponent—and pulled the trigger. The camera gun, actuated by a spring mechanism, began to "shoot," taking pictures at the rate of 100 a minute, photographing the area in front of the sights, where bullets, had they been fired, would have gone. The target plane slipped across the sights; it pulled up into the cross hairs; if machine guns rather than a camera had been used, it would have been shot down.

During the World War pilots were





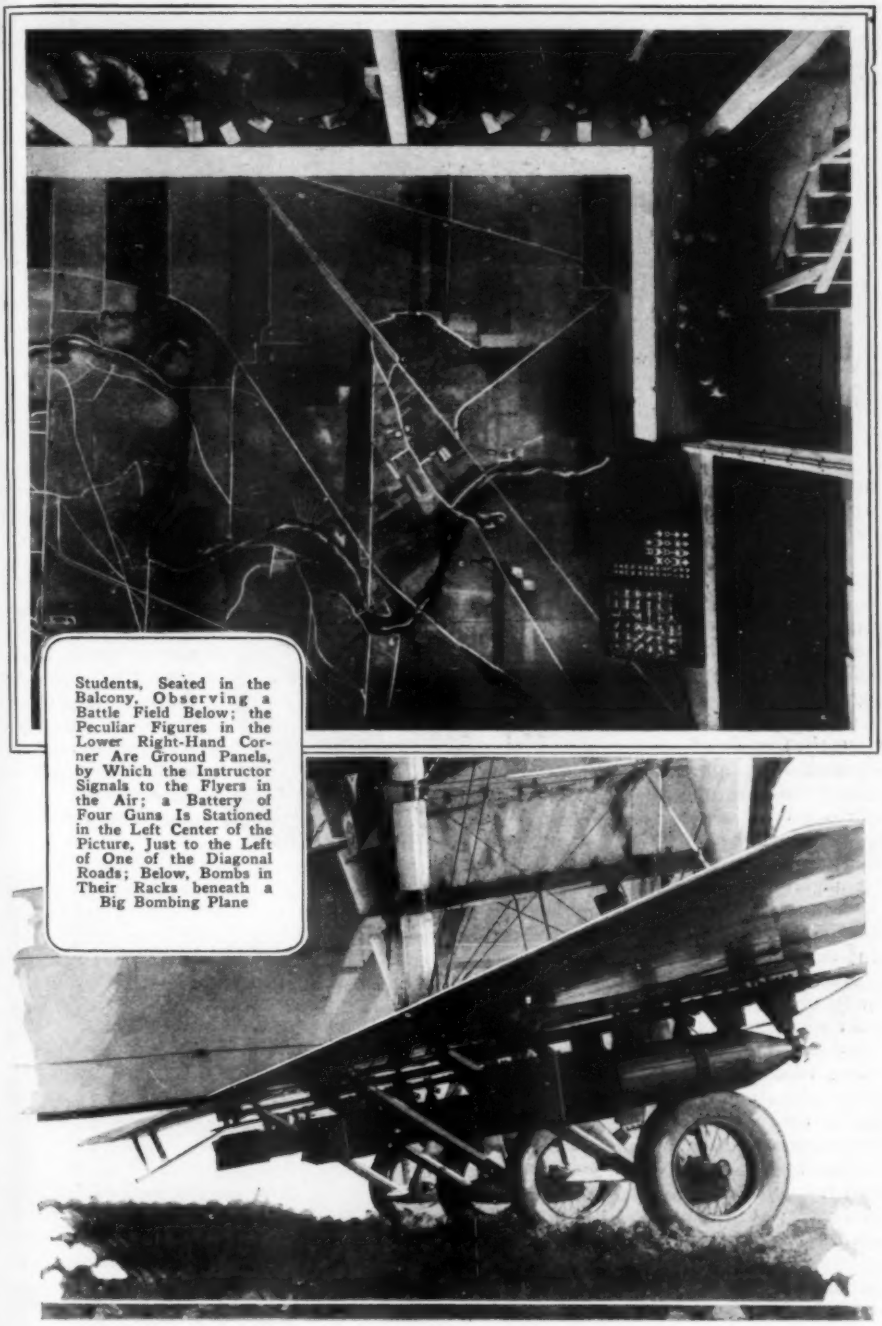
Camera "Gun" Mounted on a Lewis Machine Gun, and Some of Its Pictures; the Plane, the Target Shows, Was "Led" to Allow for Deflection

taught to shoot guns in the air by the use of small, captive balloons as targets. But the disadvantages of that system were manifold. An uninhabited area of considerable size was needed, to avoid the risk of wounding people on the ground; nor was it uncommon for the uninitiated embryo pilot to collide with his target balloon, which, in the days before parachutes were used, was practically always fatal. And having no movement of its own, the balloon presented a target much different from a darting enemy airplane.

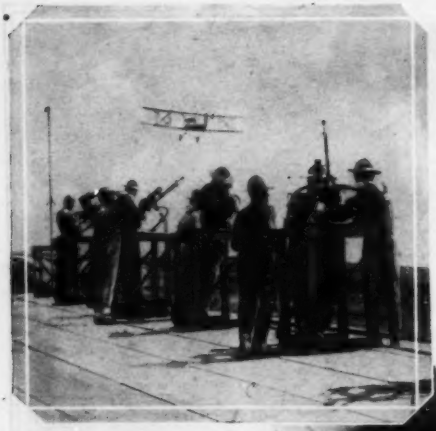
As early as 1917, efforts were made to develop a camera that could take the place of an actual machine gun in training, and the combined efforts of the Eastman corporation and the air service produced what is now known as a camera gun. Mounted on an airplane, it furnishes a complete and accurate record of each pilot's marksmanship. By means of an ingenious mirror in the latest types of camera guns, the exact second of the exposure or shot is superimposed upon the finished print, thus forestalling any argument between combating students as to which one fired the first "fatal" shot.

Later a method of giving student pilots machine-gun training on the ground was developed. In firing upon a moving object, a serious error in aim is encountered by the novice. At first, he aims his gun directly at the flying ship and fires, but by the time his bullet has been hurled from the muzzle of his gun to the target, the plane at which he is shooting has moved forward several feet, with the result that the bullet passes well to its rear.

A wooden frame, built very much like



Students, Seated in the Balcony, Observing a Battle Field Below; the Peculiar Figures in the Lower Right-Hand Corner Are Ground Panels, by Which the Instructor Signals to the Flyers in the Air; a Battery of Four Guns Is Stationed in the Left Center of the Picture, Just to the Left of One of the Diagonal Roads; Below, Bombs in Their Racks beneath a Big Bombing Plane

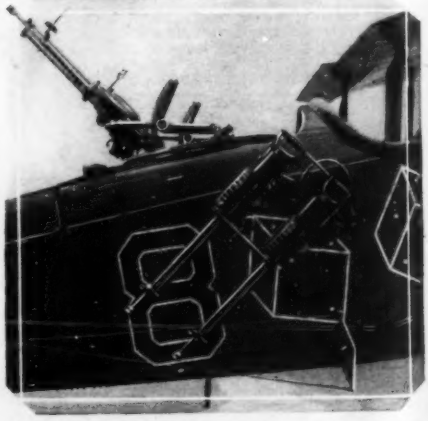


the skeleton of an airplane fuselage, and containing a full set of controls, was made, and on this a gun mount was placed. The gun, being fastened securely to the frame, was moved when the controls were moved, and thus the final development in machine-gun training on the ground was achieved. The student, to aim his gun at a given target, pushes on his rudder and control stick until his sights point at the object, then he presses his trigger on the control column and the gun fires.

But even this development was not exactly what was wanted, because until that time no targets other than the customary "bull and ring" type had been devised, and these, of course, offered no movement by which the student gunner could get training in deflection shooting. A new target was invented: A toy airplane that was attached by two eyelets to a movable wire, and this wire was pulled over a series of pulleys in such a manner that the plane traveled across the target butt in front of the gunner. Firing at a point-blank range of fifty feet, a target speed of seven and a half feet a second was the equivalent of actually firing, at a range of 200 yards, at an enemy plane traveling at sixty miles an hour.

A more recent development in the art of synthetic-warfare training is the miniature range. Here, under the supervision of a specially trained instructor, students are given all the practical problems which they will encounter in dropping bombs from great altitudes, and in co-operating with artillery units in the adjustment of artillery fire.

A model landscape, built to scale from aerial mosaics of the terrain it represents, is used in giving artillery-adjustment training. Each student is equipped with a pair of earphones and a buzzer, and a radio key which connects directly to the earphones of the instructor. Seated in a high gallery overlooking the landscape, each man watches for the flashes of light that represent the impact of artillery shells, and when these flashes come, corrections are



Brooks Students Firing Camera Guns at a Real Plane: One of the Cameras, Center, and, Bottom, Machine-Gun Mounts on a Plane

Student at Brooks Plotting the Course of a Bomber over the Camera Obscura; the Training of a Fighting Flyer Includes Many Things besides Piloting an Airplane

made immediately and a report of error is made to the instructor.

The instructor calls to the assembled students: "Bracket adjustment"—one type of artillery fire. "Lieutenant Black, make the corrections after the battery is fired."

Immediately, working at a switchboard, the instructor's assistant snaps four switches down, then presses a button, and in four different spots upon the toy landscape a flash of light appears.

Over 300 tiny electric-light bulbs are placed at points under the canvas of the model terrain, and over 300 different combinations of "bursts" are possible, bringing into play practically every conceivable error in actual artillery firing.

To Capt. S. R. Stribling, of the ordnance department, belongs the credit for solving the problem of training for heavy bombing planes. He built a traveling carpet, representing the earth, stationed his bombers in a loft directly above the carpet, and above each is a bomb sight. The bombardier sits at his sight, determines the rate of air speed by the velocity of the carpet's movement, sights upon his target, and at the proper moment pulls his bomb release.

Instead of a bomb falling to the target, however, the pulling of the release starts a stop watch, and the instructor, following the movement of the second hand, knows how long it will take the imaginary bomb to drop to the ground. Thus, if the bombing is being done, imaginarily, from 5,000 feet, the bomb will strike the ground seventeen and one-half seconds after it is released, and at that moment the instructor flashes a light at the point where the bomb would have struck.

Another ingenious device for giving bombing practice is the camera obscura. In practicing camera-obscura work, the pilot approaches the target in the same manner as when actually bombing, but at the moment at which the bomb would ordinarily be dropped, the bombardier flashes out a signal by radio to the instructor in the hut where the camera is located. In reality, this camera is nothing more than a rough lens, through which the image of the plane is cast upon a plotting table. At the signal from the bombardier, the instructor plots the path of the plane's shadow across the board, being able to grade the team in the plane, first by the time at which the bomb was supposedly dropped, and second by the straightness of the ship's path above the camera.

Filming and Recording a Home Talking Movie by Synchronizing Camera and Phonograph

TALKING MOVIES MADE IN HOME WITH SIMPLE APPARATUS

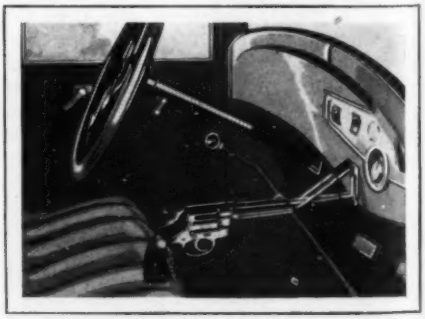
The home motion-picture camera and a small recording phonograph can be synchronized for the preparation of "talkies," a group of eastern enthusiasts have discovered. A banjo number was one of the first produced and was a success due to the careful timing of the film to correspond to the rotation of the record.

RADIO TALK WITH BYRD PLANE SETS WIRELESS RECORD

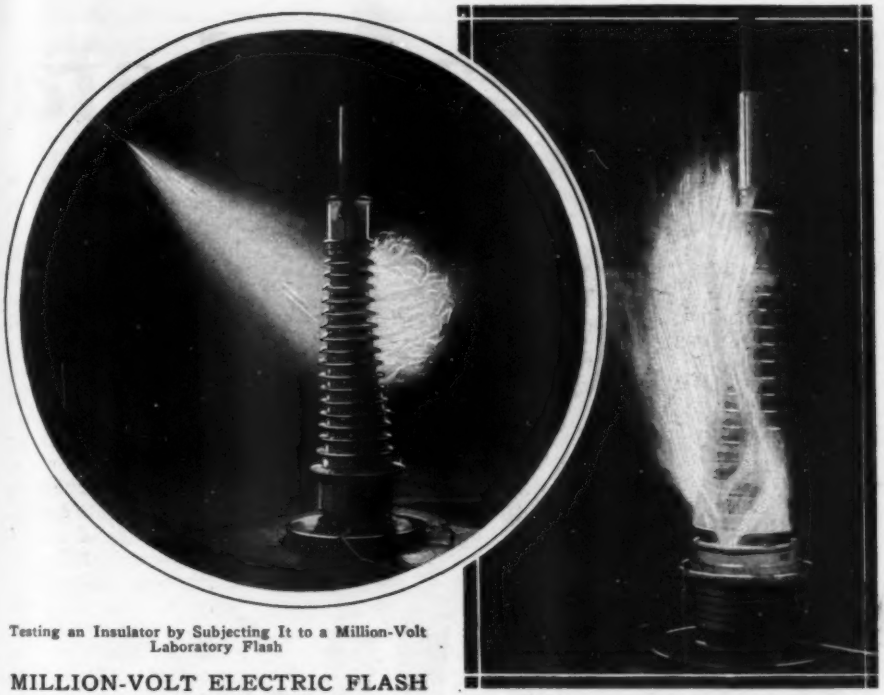
Flying 3,000 feet above the antarctic ice, Malcolm P. Hanson, radio chief of Commander Byrd's expedition, broke all previous long-distance wireless records from a moving airplane, when he talked with the New York Times radio station, 10,000 miles away. Reginold Iversen, radio engineer at the Times station, had been warned that a test would be staged from the Byrd plane "Stars and Stripes," by a call from Carl O. Peterson, operator on the steamer "City of New York," Byrd's base ship. "Listen in and try to hear the plane," was the call from Peterson at a few minutes after three o'clock in the morning. "The plane is now leaving the ice," was the next word. Iversen shifted the dial around to the thirty-four-meter mark and picked up "WFC," the "Stars and Stripes'" call. "Go ahead," he flashed back. An instant after his dot and dash "O. K." from the Times station had sped across the equator and far to the frozen south, back came Hanson's dispatch ending with the cheerful words, "sincere regards to yourself and the naval research laboratory and entire navy department on occasion of longest aircraft communication ever established. We are in flight 3,000 feet over Little America, Bay of Whales, Antarctica. Fine sunny night. Hanson." The transmission ended twelve minutes after the report had been received that the plane was to go up.

REVOLVER RACK ON AUTO DASH AIDS POLICE SQUADS

Attached to the automobile dash or other convenient place, a revolver holder has been found useful for police duty. It consists of a projecting bar held by a bracket. The revolver barrel is simply slipped over this bar so that the weapon is handy for immediate use. The holder can be taken down in a few seconds, as the bracket slips out of a socket.



Sketch of Revolver Holder Installed on Dash Where Weapon Can Be Grasped Quickly



Testing an Insulator by Subjecting It to a Million-Volt Laboratory Flash

MILLION-VOLT ELECTRIC FLASH TESTS INSULATORS

To determine the effect of lightning on bushings and insulators, experiments have been conducted in an eastern laboratory with an artificially produced flash of 1,000,000 volts. Wet-weather conditions were simulated by spraying a stream of water upon the unit under test while the electrical charge was on.

HOLLOW WALL DEADENS SOUND MORE THAN SAWDUST

Soundproofing involves careful study and practice, and scientists are just beginning to discover the proper way to protect interiors against noise. Among other interesting facts they have learned is that, under ordinary conditions, various materials that are supposed to deaden sound actually transmit it, so great care has to be exercised in constructing walls or other areas to make them soundproof. For example, hollow walls, in many instances, are better insulators against sound than those with an inner space filled with sawdust or other porous material. The filling, oftentimes, instead of keeping the sound out, helps carry it through. Walls can be made soundproof without tearing them down, by covering them with soundproofing materials which may be used as a base for plaster or may need special strips for the lathing and plastering, depending upon the kind of material used. If the room is to be insulated against sounds from within, a special soundproof plaster, that deadens echoes, literally swallowing the sound before it can bounce back again to another wall, has been prepared. It is being used with success in broadcasting studios and other interiors.

SHIP FEELS EARTHQUAKE

Sailing over the center of an earthquake just when it occurred was the experience of a British freighter recently. She was off the coast of Chile, when three heavy bumps were felt as if she were scraping the bottom, though the charts showed the depth of water to be over 400 feet.

The Great Sahara

Count de Prorok and Amenokal Akamouk, King of a Vast Tuareg Territory in the Center of the Sahara

By JAMES N. MILLER

ADVENTURES far more thrilling than those described in the current novels of burning sands and desert sheiks are described by Count Byron Kuhn de Prorok, explorer, just returned to America after two years of investigating archæological treasures in the heart of the Sahara desert. Within a few weeks he will be back in Africa once again, continuing his life work of revealing to science the secrets now concealed beneath century-old coverings of sand mountains.

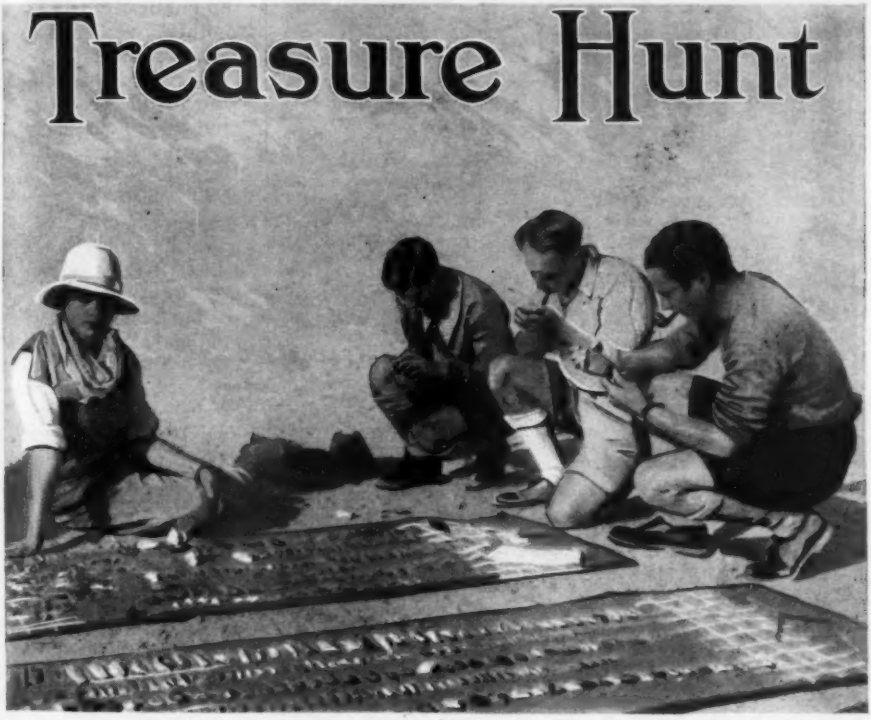
A thousand miles into the remote recesses of the world's most mysterious wasteland, filled by desert desperadoes, the count made his way on his recent trip; here meeting a people of giants close to seven feet tall but ruled over by hosts of masterful women; there almost perishing from sudden onslaughts of fierce and relentless sandstorms; while always he pressed steadily forward in the hope of solving the Sahara's most perplexing puzzle—whether or not the rumor was true that a powerful white queen, now buried amid untold riches, once ruled over a territory about as large as the United States and known as the home of the Tuaregs, descendants of the ancient Libyans, a cultured people who roamed the desert some 3,000 years ago.

Already renowned for unearthing many of the treasures of ancient Carthage, the youthful explorer, now only thirty-one years old, tells a graphic story of how he happened to go on his search for the mysterious white goddess—a search that finally met with success.

"I had long been convinced," he explains, "that the legendary queen must be far more than a fable. I had heard about her from virtually every tribe of desert folk and I knew that the belief in her one-time flesh and blood existence was adhered to by Prof. Emile Gautier, of Paris, greatest of all scholars of Sahara lore, as well as numerous other authorities.

"Back in September of 1926, therefore, I started my search by sailing from Paris, arriving at Algiers some ten days later. With me were twelve men of various scientific abilities, including Prof. Maurice

Treasure Hunt



Photos Courtesy of Count de Prorok

Countess de Prorok and Members of the Expedition Examining a Collection of Beautifully Worked Flint Instruments Gathered by Them near the Egypto-Italian Frontier

Reygasse, celebrated French archæologist, M. Louis Chapuis, well-known explorer, Henry Barth, photographer from the University of Paris, Harold Denny, of Paris, recorder of the expedition, Mohammed Belaid, famous Tuareg interpreter, and Bradley Tyrill, Pasadena, Calif., game hunter.

"Our preparations were unique. I had been studying the Sahara for a good many years and felt that camels, with all their vaunted endurance, were hardly the transportation mode for me, since they required great care. Nor was the standard automobile of much avail against the terrific onslaught of the wind and the great mountains of sand. So I finally hit upon the idea of having especially built for me three twelve-wheeled motor cars equipped with balloon tires. They worked admirably by boldly plunging through the torrid sands and bowlders and blasting many a new trail.

"We had to make careful arrangements with the French government so as to gain some assurance of safety from the desert brigands. The French responded generously. As most people know, their remarkable system of military guard consists in the maintenance, at strategic watering places, of garrisons, whose purpose it is to lend aid to law-abiding travelers as well as to protect the commercial interests of France. The men in charge are known as the 'Meharis' or military police.

"Only a few days of traveling through the picturesque Atlas mountains, and we were in the great Sahara. At this point we had no idea of the supposed location of the 'White Queen's' tomb, so we decided that it would be best to live among the natives for about a month, thereby gain-

Opening the Tombs of a Mediterranean Civilization Whose Riches Rivaled Those of the Entire Nile Region Today

ing their confidence and listening attentively to rumors of the supposed queen's whereabouts.

"Now, too, we were in the land of the Tuaregs, which word in our language means 'the abandoned of God.' In virtually every respect they are markedly different from the other desert nomads, being fair-complexioned underneath their tan, instead of black, practicing strange ceremonies and giving women an exalted place in the domestic life. In addition, the Tuaregs have resented interference from outsiders, so we had to plan painstakingly our early contacts with them. First of all we had sent ahead bales upon bales of sugar and tea, of which they are fond. Apparently our gifts had beguiled completely these desert stalwarts, for the king, Amenokal Akamouk, a jolly fellow of some fifty years of age, greeted us with open arms.

"Far from being overdrawn, the strange stories about the Tuaregs seem to me to be underestimated. The men wear veils while the women do not and the ladies possess most of the education. Not only do they control the home and family, but inheritance is likewise on their side. Even when a child is born it automatically takes its mother's, rather than its father's, name.

"Nevertheless all this woman rule prevails in a land where the men are close to seven feet tall. Beautifully proportioned and of clean-cut features, the pure-bloods are just about a hundred per cent white, though of course the strong sun has given them a coat of tan. It is laughable to think of the men as painting their lips and eyebrows, but that's not even half the story. They actually wear their hair in what looks like a fantastic kind of permanent wave. The men do not prepare their own locks, however. That is the job of the women, and they fulfill it well.

"While, to our way of thinking, many of the Tuaregs' habits are exceedingly queer, yet they have certain delightful ones that are well worth mentioning. Take their music. It is like nothing else I have heard anywhere—a sort of plaintive wail with an occasional long note like the 'zing' of the Hawaiian ukulele. The 'amarad'—the instrument most commonly used—looks like a cross between a violin and a mandolin, and it is played only by the women. Up and down, for hours at a time, they wield the crossbow.

"Another charming custom is the invariable one of conversing entirely in verse. Imagine trying to frame your commonest thoughts in such fashion! Certainly the feat requires the quickest kind of wit, but the Tuaregs are quite equal to the occasion and some of their folklore is abundant with genuine classics of poetry commemorating mighty deeds of valor.

"After a month among these fantastic folk, we managed to glean, by means of careful questioning, what seemed to be valuable information about the possible whereabouts of a tomb purported to be that of the mythical White Queen. Guided

Count Byron Kuhn de Prorok and Maurice Reygasse, Administrator of the District of Tebessa, Being Escorted to the Tombs of the Kaids and, Below, the Temple of the Oracle of Jupiter Ammon, Thirty Centuries Old; It Was Visited by Alexander the Great, Croesus of Lydia, Cato, Lysander and Hannibal, Who Braved the Desert to Consult the Oracle

The Famous Fountain of the Sun, Which Ancient Historians Said Was Warm at Night and Cool by Day

by Belaid, our Tuareg interpreter, about three days after leaving the camp of the Tuareg king, we arrived at the supposed region of the White Queen's tomb. There was no immediate sign of habitation, so far as the white Tuaregs were concerned. Though only a few miles away, we found a number of mud houses inhabited by native blacks.

"A proper excavation procedure requires the services of a good many people and we were only five in the first truck. So there was but one thing to do and that was to hire some of the blacks. Having persuaded twenty of them to join our employ, we looked around us more carefully and noted what seemed to be a great circular monument, about 100 feet around, forty feet high and made up of great volcanic rocks, beautifully sculptured and wrought with ancient Libyan inscriptions.

"And now a few explanatory words about the accepted way to excavate a desert tomb. Of course, big spades are used, but every single shovelful of sand must be sifted painstakingly so as to make sure that no possible small treasure will be missed. Thus every member of our party had a hand sieve, and shoulder to shoulder we dug our way down, looking for all the world like a group of gold-seeking prospectors. As indeed we were, in a sense.

"Down at the base of the monument we could early see the outlines of the tombs of twelve noblemen. Each tomb was about fifteen feet square and eight feet high, we discovered. Being pressed for time, we forced our way right through the heart of the monument, penetrating sand and stone alike. And most of the stones, mind you, were about two feet by three in size and were heavy enough to require two men to transport them from their original position. At a rough estimate, I would say that we removed in such fashion thousands of great stones within our two weeks of excavating.

"For five days we kept right along, digging and sieving with remarkable zeal, considering the circumstances. Then, I made my first great discovery, a tiny red object about the size of a fingernail. It was a coral bead, almost identical with certain beads I had found some years before while probing the ruins of ancient Carthage.

"Shortly thereafter I found quite a few emeralds and garnets (cousins to the ruby) besides a great abundance of semi-precious stones. By this time we had worked our way down through stone and sand clear to the monument's floor. A few more deft movements of our spades, and our delighted and astonished eyes were offered the once-in-a-lifetime treat of a veritable Aladdin's carpet, covering the entire floor, red in color, made of leather and possessed of a beautifully wrought fringe about six inches long. It was preserved almost perfectly because the extreme dryness of the Sahara serves to keep most materials more or less intact for centuries.

"Among the objects found next, in the order named, were: a rock-crystal vase and a funny-looking nine-inch statuette of a broad-shouldered woman. This last was of the utmost importance because it heralded the greatest find of all. A few moments more of brushing the sand away,

and right beside this statuette was found a perfectly preserved skull of a woman close to seventy years old. The condition of the sharp-edged teeth told us that. It was the skull of the White Queen herself.

"With utmost care we continued to remove, with our brushes and bellows, the coating of sand in the surrounding region and soon found remnants of the entire corpse, including hundreds of delicately fashioned beads and all manner of precious jewels. The royal lady had been lying on a magnificent canopy of sculptured wood, portions of which were in well-nigh perfect condition. On her head had been a tiara, or jewel-containing garment, besides three feathers. This last discovery indicated strongly that the White Queen had been a veritable Amazon who had fought during warfare periods.

"After leaving Insalah we were caught in a terrific sandstorm with certain dunes towering 1,400 feet high, and soon the three trucks became separated. My truck finally bore several of us safely to Oargla, a French fortress a few hundred miles away. We told the officials where we had last seen our companions and immediately a search party was organized. But fortunately the lost members in their two trucks staggered into Oargla two days later.

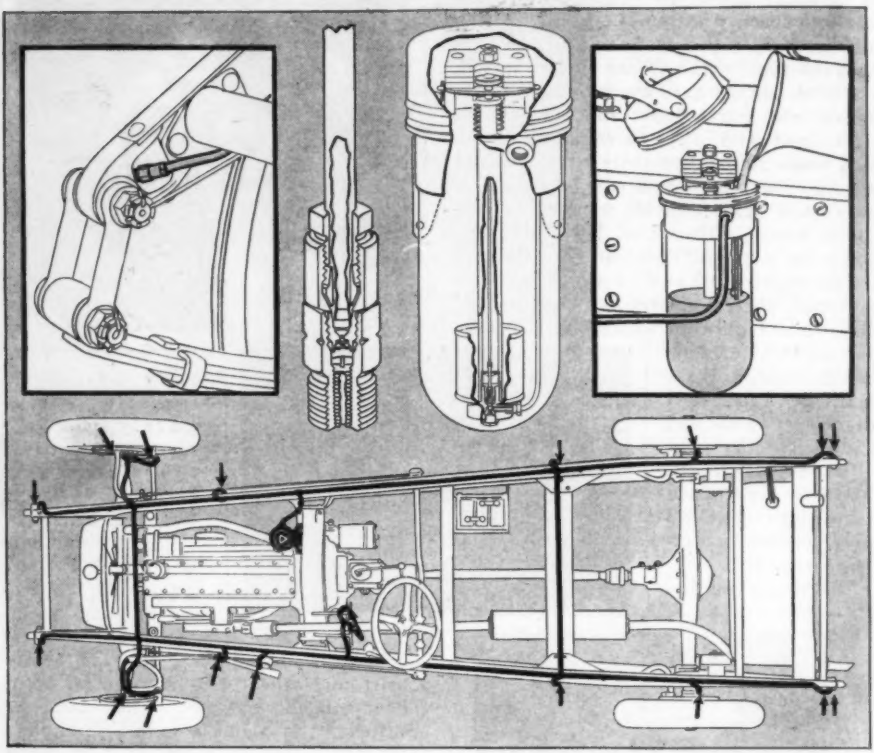
Excavating Tombs of the Amoriens, a Collection of Silver Coins of Alexander the Great, Found in the Desert, and de Prorok Meeting the Chief Guide of the Expedition

"About the date of our find there was much controversy, some members of our party thinking it harked back to days before Christ, and others, that it dated far later. The argument was not settled until we reached Paris about a month later, and that was a curious situation. It seems that we had found a small wooden bowl, or vase, with silver designs on it. But since we had so many little curios to examine, we hadn't taken the trouble, while in Africa, to scrutinize this particular one very carefully. But one day in Paris I was entertaining a group of scientists and happened to be idly cleaning the vase, when underneath the sand and dirt I suddenly beheld three metal objects. They were Roman coins and their presence in the curio left no doubt but that our party had found the White Queen."

GEESE WEED BERRY PATCH

Geese have been used as a substitute for laborers in keeping a North Carolina strawberry patch free from grass, and the practice is said to be spreading throughout the south. The birds eat the grass but do not touch the berries or plants.

AUTOMATIC OILER REACHES ALL PARTS OF THE CAR



Sketches of the Automatic Chassis-Lubricating System; Top Row from Left to Right, Bearing Connection, Cross Section of Resistance Unit, the Pump, Filling Reservoir and, Below, Scheme of Entire System

Continuous and automatic lubrication for the automobile chassis is afforded in a system that utilizes the effect of road shocks while the car is in motion to keep all bearings thoroughly oiled. All the motorist needs do is to fill the reservoir. There is nothing to push or pull, for the car literally lubricates itself. This is accomplished by the action of a pump inside the oil reservoir, a glass container installed under the hood, on the dash or in any other suitable place. The pump is so adjusted that it is operated by the jarring of the car. This motion causes oil to be forced into the line. To control the flow, resistance units are installed at each bearing. They govern the amount of oil that reaches the bearings and are also fitted with a fine screen to keep out foreign substances. A small check valve is incorporated in each resistance unit to prevent the system from draining, a trouble likely to occur, since some of the bearings are higher than others. By turning a screw in the pump, the amount of oil to be fed into the line can be regulated. This is the only adjustment necessary.

PLANE SOLVES SEA MYSTERY IN FINDING SHIP

Lost for six days after a storm, and unable to communicate with ship or land, the Russian motor vessel "Communa," with twenty-six persons aboard, was found by airplane recently. The boat's engines had been disabled and it was helplessly drifting when it was seen by observers in the low-flying plane. A tug was sent to the rescue.

KILL GERMS THAT EAT STONE TO PRESERVE BUILDINGS

Scientists are waging a chemical warfare against harmful germs that devour stone and other building materials. Some sixty different species of organisms that eat stone and other substances have been discovered, and chemicals that will kill them without damaging the material are being sought. The germs weaken structures by opening pores in the surface, thus exposing it more to the weather and causing it to crumble. It has been found that some of the bacteria will cause erosion in the hardest marble in three weeks. Investigators have found that beetles and some other insects that have been blamed for damage to buildings are not at fault.

MOTOR SKIS AT SWISS RESORT GIVE WINTER THRILLS

St. Moritz, Switzerland, long has been famous for its winter sports, and this season a new one was provided in motor skis for fast travel over snow and ice. The rider, wearing skis, sits on a third one to which a motor has been attached. The controls are within convenient reach, and the operator easily balances himself with the aid of the outer skis.

Tri-Ski Speed Outfit for Fun in Winter Snows, with the Motor Unit Mounted on the Center Ski

Greasing Bearing through Special Fitting, and a Close View of Installation

FITTING CLOSES OPEN OIL HOLE AND SAVES WASTE

High-pressure fittings have been introduced for open oil holes on machinery to keep out the dirt, save waste and afford the benefits of pressure lubrication to parts that ordinarily are oiled in a more or less haphazard manner. The units involve no threading operation and can be installed in a few minutes. First, a bushing is driven into the hole and into the top of this is inserted a nipple with a dirtproof ball-check valve. An ordinary hammer and three special tools form the necessary equipment for installing the fittings. So equipped, the parts can be lubricated with a pressure gun.

SEA GRASS STOPS SOUND AND KEEPS BUILDINGS WARM

Builders have discovered that a common variety of sea grass is serviceable as an insulator against sound, heat and cold. Like other cellular substances, when dried, it proves an effective shield against noise and is said not to harbor insects while it is practically fireproof. It is being used extensively in some sections for upholstery and mattresses.

The World's

IN UNCLE SAM'S big science mill at Washington, where practically everything under the sun is made, perfected, studied or examined so that we may be happier, healthier and live more comfortably, there are hundreds of experts who spend scores of years and sometimes entire lifetimes on research projects of the queerest kind imaginable.

One, for instance, with the tongue-twisting title of "helminthologist," spends hours examining under the microscope the almost countless varieties of strange parasites that prey particularly on humans; another often has to stick his head deep into funny-looking and especially devised contraptions so as to watch the frolicsome maneuvers of those fantastic, whiplike organisms of almost uncanny shapes, sizes and descriptions that are known as "nematodes"; while, in virtually every sizable aviation field of the army air corps, there are specialists called "dopesters," whose main job is to cover sections of recently repaired planes with a chemical compound so poisonous that some of the appliers actually have to drink as many as five quarts of milk a day in order to counteract the dope that seeps into their system and makes them "groggy."

Dr. W. W. Coblentz, of the Bureau of Standards, Testing Glass Screens to Protect Movie Stars from Kleig Lights, and Miss Eloise Cram, Bureau of Animal Husbandry, Examining Chicken Pests

Queerest Jobs

A Government Chemist Practicing Ultra-Filtration in a Delicate Test, One of Many Made Daily

Not all these jobs, of course, are dangerous, and may be it's not quite fair to call them queer, since every one seems to be absolutely essential in advancing the almost breath-taking hop, skip and jumps of modern-day science. Yet, to the average person, they are bound to take on a singularly strange, or at any rate novel, character.

Take the case of William N. Dovenor. He is an artist and, in his official capacity as chief scientific illustrator to the bureau of entomology, his main task is to devise a rogues' gallery of insects harmful to man and orchard. Ask him what he has been doing for the past sixteen years and he'll reply "everything under the sun," while explaining that first of all his purpose is to sketch the complete life history of the knaves of "bugology" so that the farmer and gardener may learn how best to control them and so protect their crops.

To hold a job like that requires the utmost patience and painstaking study. May be for as long as ten days, or even two weeks, Mr. Dovenor, in the recesses of his studio, will be called upon to spend every available working hour studying the wrigglings of a single insect larva that isn't much more than visible to the naked eye. But it is just such seemingly inconsequential creatures that devastate and destroy hundreds of thousands of acres of corn, tobacco or cotton.

On one single canvas, containing but twenty-six views of twelve different larvæ, his endeavors occupied several months.

Movie stars may not realize the fact, but it is nevertheless true, that much of their indebtedness for relief from the strained-eye ailment, known in its advanced stages as "Kleig eyes," is due to the efforts of Dr. W. W. Coblentz, of the bureau of standards. When the subject was first brought to his attention, he conducted many tests with various glasses to cap the high-powered Kleig lights. But not so long ago he made the astonishing discovery that probably the very best thing for the purpose was ordinary window glass. The reason is that it does not transmit the piercing ultraviolet rays, a situation that, strangely enough, has caused window glass to be condemned rather universally by the health experts.

The helminthologist is Dr. Maurice Hall, best known, probably, for having done more in devising ways to combat the persistent human tapeworm than any man in America. There have been times when Doctor Hall has swallowed the undigestible creatures, and now and again the results have placed him pretty close to the martyr list of research workers.

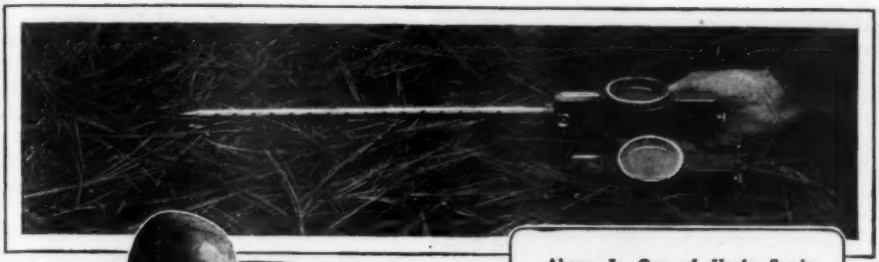
Similar to Doctor Hall's is the everyday work of Miss Eloise B. Cram, zoologist, whose study of internal parasites is confined to chickens and pigs rather than humans. Her efforts alone undoubtedly save American farmers hundreds of thousands of dollars each year. Her chief occupation just now is to find out how the serious poultry diseases are spread. She has long held the idea that, may be, the cockroach, the grasshopper, or else the cricket has had a hand in the situation, and lately she has proved that insects indeed are to some extent guilty of transmitting the diseases.

In the same general line of work as Doctor Hall and Miss Cram is Dr. N. A. Cobb, who bears the title of "nematologist." Thus graphically does he describe the vital importance of his studies: "If all the substance of the earth and of the things that flourish on it, with the exception of the threadlike organisms known as nemas or nematodes, could by a stroke of magic be made invisible, then it would still be possible to distinguish the soil-covered parts of the earth, the streams, lakes and oceans, the insects, animals, birds, fishes, plants and humans. So widespread and abundant are the nemas, that in this imagined world of transparencies most living things, such as the blanket of soil on mountains, hills, and plains, and the bodies of water would be indicated by clouds of these living threads which vary in length from a small fraction of an inch to several feet, and in diameter from that of the finest of hairs to the thickness of a lead pencil."

An observer, looking through a high-power microscope, views in a lighted field a world as complex and as full of mystery as that we see daily with the unaided eye. There are poorly lighted recesses in this world that hold their secrets tenaciously and seem to require for their exploration something comparable to the spotlight in a darkened room.

Just such a spotlight has been recently discovered by Doctor Cobb. Knowing, of course, that when the image of the sun is reflected into the field of vision of the microscope, its brilliance is far too great for the unprotected eye, he investigated further. To his surprise he found that on hazy days he could actually form the image of the sun on the tissues inside the object being examined. This bright spot lights up the surrounding tissue, en-

Mixing Deadly Potions, to Be Tried Out on Cockroaches and Other Insect Pests, Is the Regular Job of J. W. Sale and J. B. Wilson, of the Food, Drug and Insecticide Bureau



Above Is One of Uncle Sam's Many Unusual Tasks, Holding a Duff Hygrometer on the Ground to Determine Whether the Moisture Content of the Grass Is So Low as to Cause Fire Danger; at Left, Dr. M. C. Hall, "Helminthologist" Who Studies Parasites

An Artist Is Retained by the Department of Agriculture to Paint Garden Bugs; Below, One of the Special Microscopes Used to Study Minute Organisms That Prey on Animals

abling the observer to see plainly what did not appear under ordinary illumination.

So Doctor Cobb, since then, has been experimenting with various means of duplicating the effect of the sun as seen through a

hazy atmosphere. He tried out glass-walled boxes containing smoke, then fumes of ammonium chloride, next water containing milk, and so on, down through a lengthy list. He achieved an especially good result by the use of a huge sheet of glass very finely etched with acid. Deeply colored glass, especially green or blue, may be used to advantage, he found, so that, with such a glass sheet between the sun and the microscope condenser, the sun's image can be used to search out the otherwise obscure spots.

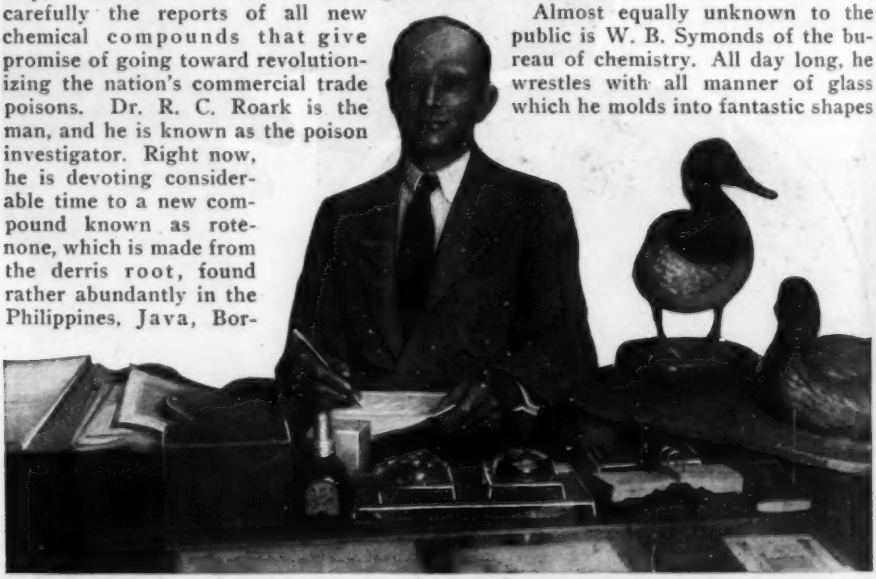
Those dopesters of the army air corps, mentioned earlier, use such poisons as cellulose acetate and cellulose nitrate for the reason that they tend to fill the pores in the outer fabric of the plane and cause it to shrink, thereby giving it an airtight and smooth surface. The plane as a whole is not covered in this way because that has been attended to by the commercial makers of the ship. It is only the wings that have been temporarily broken and have just been patched up, that need the dope.

Speaking of poisons, there is an official of the bureau of chemistry and soils whose major task is to watch for and investigate carefully the reports of all new chemical compounds that give promise of going toward revolutionizing the nation's commercial trade poisons. Dr. R. C. Roark is the man, and he is known as the poison investigator. Right now, he is devoting considerable time to a new compound known as rotenone, which is made from the derris root, found rather abundantly in the Philippines, Java, Borneo, Sumatra and the Malay peninsula. It has been claimed, though not authoritatively, that the natives of those places have used the root for the purpose of killing fish, by simply putting a tiny quantity of the poisonous substance in the water, whereupon, within a few hours, the swimmers die and float to the surface to be caught readily.

The claim might be true enough at that, experts say, since tests show that one part in a million can kill minnows with an exposure of twenty-seven hours. But if derris root kills minnows, why doesn't it deal death also to humans? Because it has the peculiar habit of quickly becoming decomposed and inert. Which is why it shows splendid prospects of being valuable as a spray, possibly taking the place of the deadly lead arsenate. Rotenone shows further promise in that it is soluble in certain oils without losing its strength.

A somewhat different study of poisons is conducted under J. W. Sale and J. B. Wilson, of the food, drug and insecticide administration. To them falls the lot of mixing up concoctions that spell speedy destruction to the cockroach and its insect cousins.

Almost equally unknown to the public is W. B. Symonds of the bureau of chemistry. All day long, he wrestles with all manner of glass which he molds into fantastic shapes

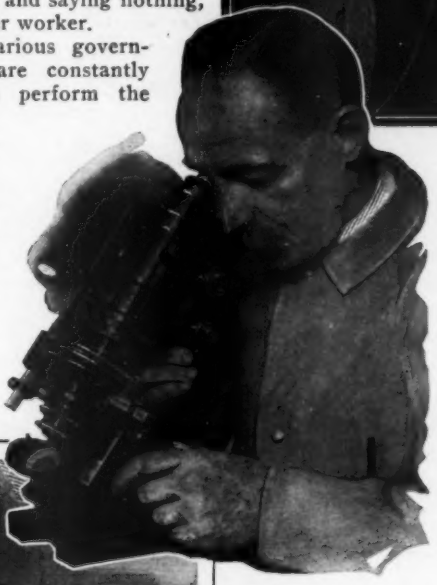


H. P. Sheldon, of the U. S. Biological Survey, Spends His Time Figuring Out Where the Wild Birds of the Nation Live at Various Seasons of the Year

for famous men who must have, at a moment's notice, the practical results of intricate-looking blueprint ideas.

Who ever heard of "ultra-filtration"? The word sounds highbrow and is, for it must have the guidance of an expert who understands the highly intricate work of filtering carbohydrates (starches and sugars) to just about their finest possible point. Such a man is L. E. Dawson, government chemist, whose efforts in this connection are invaluable to the sugar and candy industries. Like W. B. Symonds, and most of the other government scientists who perform miracles for you and me while sitting tight and saying nothing, he is literally a wonder worker.

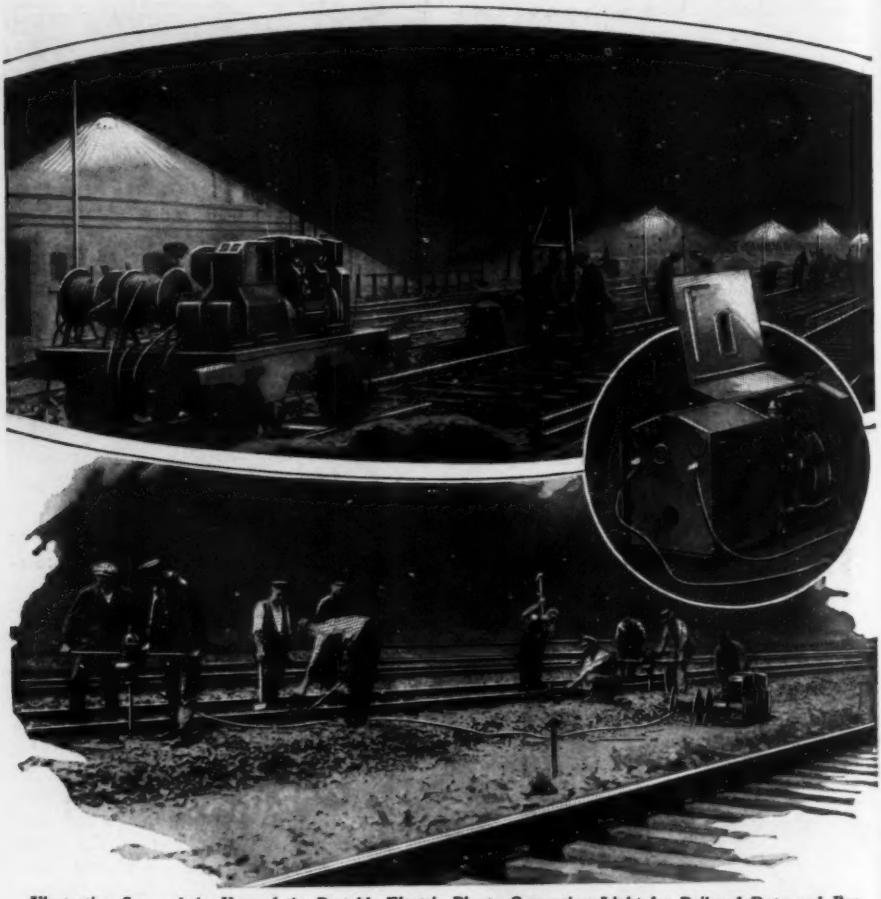
Experts in the various government departments are constantly being called on to perform the seemingly impossible. One classic example is the order from Doctor Langley, when he was secretary of the Smithsonian, instructing an aide to drill a hole lengthwise through a needle much finer than those used for hypodermic injections. The task was completed successfully.



Chemists Found Milk an Antidote for Poisoning from Aircraft Wing "Dope"; Studying Nematodes Is Doctor Cobb's Job; Bottom, W. B. Symonds Blows All Special Glass Apparatus

Recently the bureau of standards, helping prepare a government exhibit to be shown at the Spanish exposition at Seville, Spain, this summer, solved the problem of getting an accurate count of the number of visitors who inspect the American exhibit by building a light-beam counter. A small light is to be placed at one side of the gate, focused on a photoelectric cell hidden in the other side. Every person passing through the gate will interrupt the light, momentarily stopping the current generated in the light-sensitive cell, and this in turn will operate a relay controlling the automatic counter.

The bureau of standards carries out an immense amount of scientific research work. One of its sections does nothing but study fires. A single report, recently issued on the fire-resisting qualities of hollow tile when used in load-bearing walls, fills a volume of over 330 pages.



Illustrating Some of the Uses of the Portable Electric Plant; Generating Light for Railroad Duty and Furnishing Power for Drills; Inset Shows Close View of Unit

ELECTRIC PLANT IS PORTABLE FOR LIGHT AND POWER

For service in places where power lines are not available, a portable electric plant, operated by a gasoline or oil-burning motor, has been devised by German engineers. It furnishes illumination or drives tools of different kinds and is especially adapted for service along railroads. Cables are provided for operating several machines and lights at the same time.

WOMEN GAINING AS INVENTORS PATENT RECORDS SHOW

In Kansas lives a woman whose chief occupation is raising chickens but she has found time to invent a doll that can walk, dance, sit down, cross its legs and do other things that humans can do. She obtained patents on the doll just recently, thus increasing the growing list of women who are making names for themselves as inventors. Between 1790 and 1910, more than 11,000 patents were granted to women in this country. In England, women were granted 500 patents in one year, and a firm of patent lawyers there reports that more inventions by women are now being handled than ever before. Their

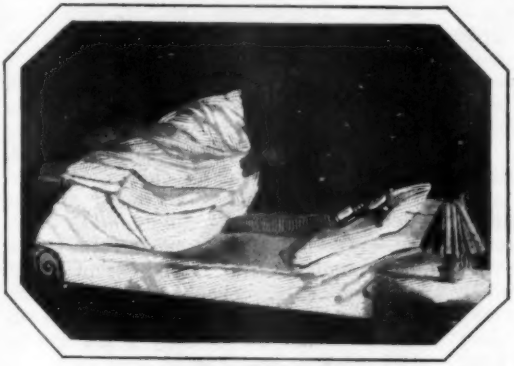
ideas cover not only the household field but extend to aviation, motoring and other activities. Among those winning prize awards from the General Electric company recently, was a woman employe who had developed a means for faster work on the armatures of small washing-machine motors.

TRACING CLOTH FOR CURTAINS ADMITS HEALTHFUL RAYS

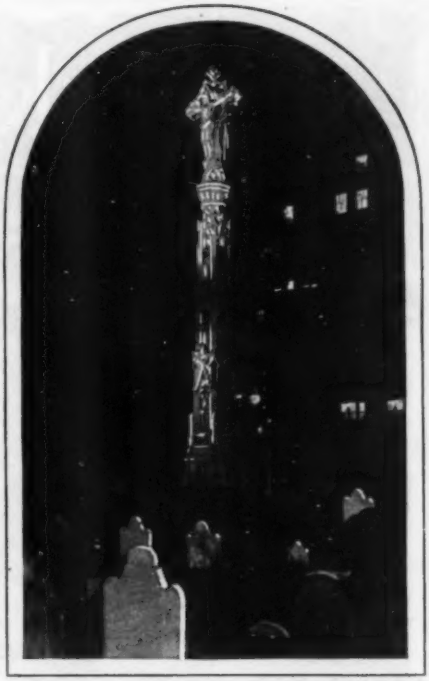
Tracing cloth used by draftsmen in blueprinting drawings may become popular as a curtain material as a result of an accidental discovery that the fabric admits the healthful ultraviolet rays of the sun, usually excluded by paper and other kinds of cloth. It has been suggested that the material be placed in single thickness between wide-meshed wire screens to replace curtains and blinds in dwellings.

ELECTRIC HEATER WARMS BED AND SERVES AS DRIER

To warm beds, an electric heater, operating on somewhat the same principle as a hair drier, has been introduced in Germany. It is run from a lighting socket and when used in a bed, is placed upon the pillow with the nozzle down and the reverse side exposed so that air can be drawn through openings. The air is heated by the electric element and is fanned down inside the covers, circulation being insured with the aid of a coil spring which is laid lengthwise in the bed.



Adjusting the Bed Warmer; the Blower, with Inlet Holes Upward, Forces Warm Air along Spring Coil



Memorial to Mrs. William Astor as It Appears under Floodlights in Old Trinity Churchyard, New York

LIGHTS ON CHURCHYARD CROSS REVEAL MEMORIAL'S BEAUTY

Persons working late in Wall street often stop at night to gaze at the illuminated crucifix, thirty-nine feet high, erected some time ago to the memory of Mrs. William Astor. Four floodlights focus their beams on the cross, which is of white marble and stands in the old Trinity churchyard. Besides the figures of Christ and the madonna and child, representations of other Biblical characters are included among the decorations.

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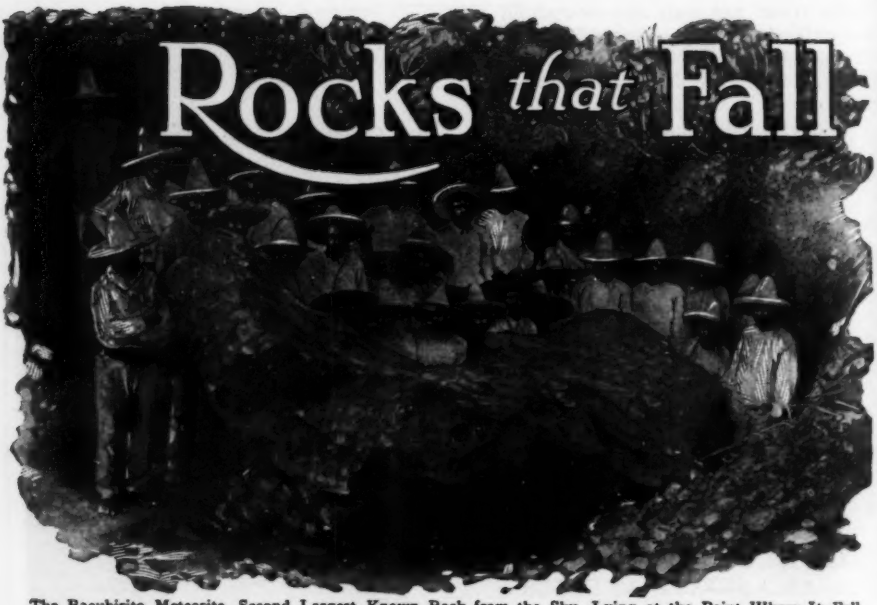
Rocks *that* Fall



The Bacubirito Meteorite, Second Largest Known Rock from the Sky, Lying at the Point Where It Fell in the State of Sinaloa, on the West Coast of Mexico

By CALVIN FRAZER

ONE REASON why the moon is not fit for human habitation, besides the two well-known facts that it has no atmosphere and is subject to unendurable extremes of temperature, is that it undergoes the incessant bombardment of innumerable meteors. The majority of these bodies are no larger than grains of sand but have great penetrating power, as they fly at speeds ranging up to forty miles or more a second. Many, moreover, are as big as baseballs, and some are great bowlders weighing hundreds of pounds or even several tons. A human visitor to the moon would almost certainly be hit sooner or later by one of these deadly missiles.

An interesting consequence of this fusillade of meteors upon the moon has lately been pointed out by Professor Olivier, a leading American student of meteoric phenomena. Astronomers have long conjectured that the so-called lunar craters, instead of being extinct volcanoes, may be the scars left by the impact of giant meteors. Whether or not this is true, says Professor Olivier, it is quite certain that the continual fall of meteors of moderate size must, in the course of ages, have produced a sort of sand-blast effect upon the lunar surface, quite comparable to the erosion by wind and water that has sculptured the surface of the earth.

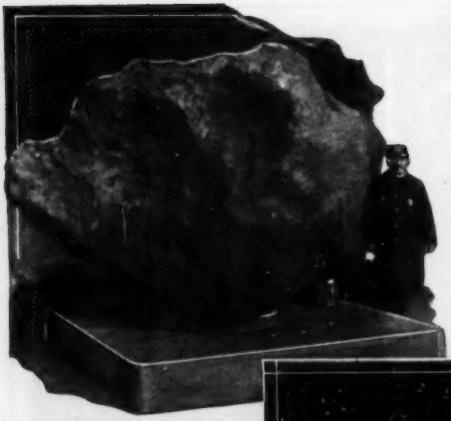
Only the presence of a surrounding envelope of air saves our own planet from a similar bombardment. It is estimated that fully 20,000,000 meteors enter the earth's atmosphere every twenty-four hours. The air protects us from these missiles in two ways. First, even in the thin upper layers of the atmosphere, the meteors are intensely heated by friction, and most of them are completely burned up or reduced to an impalpable powder long before they can reach the earth. Second, the resistance of the air checks the speed of those that reach the ground, so that they do not, as a rule, hit the earth much harder than would bodies of the same weight falling from the height of a few miles. The bigger ones fall with much violence, but small specimens have been known to fall on ice only a few inches thick without breaking it.

Meteors that fall to the earth are called meteorites. These vary greatly in size.

A Bursting Meteorite That Terrified the Natives at Chandpur, Northwest Provinces, India, on April 6, 1885; the Photograph Is Made from a Contemporary Drawing

The smallest thus far found were no larger than grape seeds, while the largest of all is the Cape York meteorite, weighing thirty-six and one-half tons, which Lieutenant Peary brought down from Greenland in 1897, and which is now in the American Museum of Natural History. About half of all the meteorites now preserved in museums were actually seen to fall. The rest are known to be meteorites because they possess certain features characteristic of such bodies. The museum specimens represent nearly 900 distinct falls, and the total number of meteorites discovered up to date mounts up into the thousands.

Probably hundreds fall for every one that is recovered, but, even so, the fall of



a meteorite is an exceedingly rare event in any one locality. The late Prof. C. A. Young made a rough guess to the effect that the total amount of meteoric matter falling to the earth averages 36,500 tons a year. At first sight, this total seems large enough to make the falling of meteorites a rather serious danger to humanity. It is, however, so small in proportion to the area of the globe that, if the material falling at this rate were spread evenly over the earth's surface, it would make a layer only about an inch thick in the course of a billion years. Moreover, the vast majority of meteorites are too small to be capable of causing much damage.

Nobody need lose any sleep over the danger of being hit by a meteorite. Neither would anybody be justified in insuring his property against a similar danger. If an insurance company could persuade a large number of gullible people to take out insurance of this sort, the company might operate for centuries without paying out a cent to its policy holders. Nevertheless, in the long run and on the earth as a whole, meteorites do cause a certain amount of damage, and there is a bare possibility that some day a fall of these bodies may be responsible for a more colossal disaster than any volcanic eruption, earthquake or flood that has ever befallen the human race.

This possibility was vividly brought to mind a short time ago by the belated news of an event that happened in the wilds of Siberia in the summer of 1908. On June 30, about seven o'clock in the morning, a magnificent falling star, of dazzling brilliancy, was observed in the northern sky by thousands of people in the southern part of the province of Yenisei. The place of fall long remained a mystery, but in the summer of 1927, an expedition under Prof. L. A. Kulik located it in the midst of an almost inaccessible forest lying north of the "Stony"

Peary's Cape York Meteor; Halley's Comet, Parent of a Swarm of Them, and Meteor Crater as Seen from the Air; the Black Specks in the Foreground Are Trees

On the Rim of Meteor Crater, the Vast Hole in Arizona Which Has Puzzled Science; the Rim Is Lined with These Huge Bowlders, Thrown Up by the Violent Impact

Tunguska river, in about latitude 61 degrees north and longitude 102 degrees east.

This region is very sparsely inhabited by half-civilized Tunguses, and this fact, together with a complete lack of roads and telegraph lines, explains why details of the meteor fall were so slow in reaching the rest of the world. Kulik has recently returned to civilization with a wonderful story of what he found. Where the meteorite struck, there is now an area several miles in diameter where the earth is torn and furrowed as though by a gigantic harrow and pitted by large funnel-shaped cavities, like shell holes. Around this central area, in a circle scores of miles in diameter, millions of dead trees lie like a vast forest of fallen ninepins. They are all stripped of their bark and branches, and each tree lies with its top pointing outward from the center of the devastated area. All the vegetation for miles around shows the effects of a uniform scorching, quite different in appearance from that caused by a forest fire.

Evidently a meteorite of extraordinary size burst in mid-air and rained down its fragments upon the earth, or else the falling material consisted of a swarm of meteorites traveling together through space. The sudden compression of the air under these falling masses must have generated great heat and sent out in all directions a hurricanelike blast that felled and shattered the trees. The outrush of this hot air was actually observed by several natives in the surrounding country. One man, forty miles from the place of the fall, was hurled several feet by the air wave, which felt so hot that he thought his clothes would catch fire. His house was wrecked by the same wave.

Another man had stores and a herd of 1,500 reindeer in the forest at the time of the fall. Only a few scorched carcasses of these animals could be found after the event; the rest were completely annihilated. The storehouse was burned down, and a number of tools that it contained were melted. At Lalka, 400 miles from the center of disturbance, railroad employes felt the air wave and heard a roaring sound. Even at the observatory of Irkutsk, 800 miles away, the air wave was registered by a barograph, and the shock of the falling mass was recorded by a seismograph. No specimens of the meteoric material have yet been recovered from this fall. The fragments are probably buried deep in the earth, and it would be a difficult task to transport to the spot

suitable tools for digging them up, but this will doubtless be done eventually. A survey of the region by aeroplane will probably be carried out next summer.

As one part of the globe is as likely to be bombarded as another, it was merely a lucky chance in this case that directed the celestial missiles toward a wilderness rather than toward some densely populated region. If London or New York, for example, had been the target, the results would certainly have been appalling. Millions of lives would have been lost, and billions of dollars' worth of property would have been wiped out. It is comforting to reflect, however, that such a meteor fall as occurred in Siberia is almost unprecedented in the world's history.

Almost, but not quite. About thirty-five miles east of Flagstaff, Ariz., near the long ravine known as Canyon Diablo, there is a remarkable craterlike hole in the ground, 4,000 feet in diameter and 600 feet deep. No evidence of volcanic activity exists in the neighborhood, and though at one time there was much controversy in scientific circles about the origin of the hole, it is now generally admitted to have been formed by the fall of a huge meteorite or cluster of meteorites. A great number of iron meteorites have actually been found within a few miles of this spot. The principal mass of material is supposed to be buried hundreds of feet underground, and several unsuccessful attempts have been made to reach it, on account of the probable value of the meteoric iron, to say nothing of the chance that it may contain diamonds, which have occasionally been found in meteorites.

The walls of this curious formation rise well above the surrounding desert, so that, at a distance, it looks an isolated hill of the flat-topped variety common in the southwest, and it was formerly called Coon Butte, but is now known at Meteor Crater. Trees growing on its side are fully seven hundred years old. On the other hand, the crater shows but slight indications of erosion, so that it cannot be very ancient. Navajo Indians living in the neighborhood have a tradition that fire once fell from heaven and destroyed members of their tribe. Probably the meteor fall that produced the crater happened well within the span of human history, and at a time when civilized communities and flourishing cities already existed in some parts of the world.

A few other craterlike formations on the earth, including one recently discovered in Esthonia, may possibly have been due to meteoric bombardment, but there is no convincing evidence that they originated in this way. Turning, now, to some of the more definitely recorded effects of falling meteorites, we find that in perhaps a dozen cases—most of them dating back many centuries—people were said to have been killed by meteorites. The evidence in all these cases is too uncertain to be conclusive, but, of course, such an event is entirely possible and has probably happened more than once. There have been some narrow escapes even in modern times. Thus at Braunau, Bohemia, in

A View across Meteor Crater from the Southeast Wall; Recent Tunneling Has Convinced the Owners the Huge Mass of the Main Meteor Has Been Located Far Underground

1847, an iron meteorite weighing nearly forty pounds fell in a room where some children were sleeping and covered them with debris, but did them no serious harm. At Charsonville, France, a meteorite fell on a road between two teamsters, throwing up the ground to a height of six feet. Roofs have been penetrated in several cases. A dog was killed by a meteorite at Nakhla, Egypt, in 1911.

Stories of buildings being set on fire by these bodies are usually taken with a grain of salt by the authorities. The scorching effect of the great Siberian fall was probably due, wholly or mainly, to the compression of the air and was altogether exceptional. Ordinary meteorites are heated to an enormous temperature during their passage through the air, but the heating is so brief that it is a mere skin effect and the heat is quickly lost when the object comes to rest. Meteorites found immediately after their fall are generally cold or lukewarm, though some have been described as "too hot to handle." No baking of the ground or charring of vegetation has ever been observed at the place of fall, except in the one case mentioned.

NINE-HOLE INDOOR GOLF SET IMPROVES PUTTING

Competitive features help make an indoor golf game more interesting and give the players valuable practice in putting and other strokes. The set is a miniature nine-hole golf course, the object of the game being to sink the balls in the holes from the tee and thereby score the points indicated for each hole on a small flag that automatically turns to designate the score when a ball has been sunk. Each player gets nine balls to the game and may play the holes in any order desired. Balls returning down the slope may be played over, those remaining on the field should not be removed until after the game and those that bounce off the board cannot be played over.

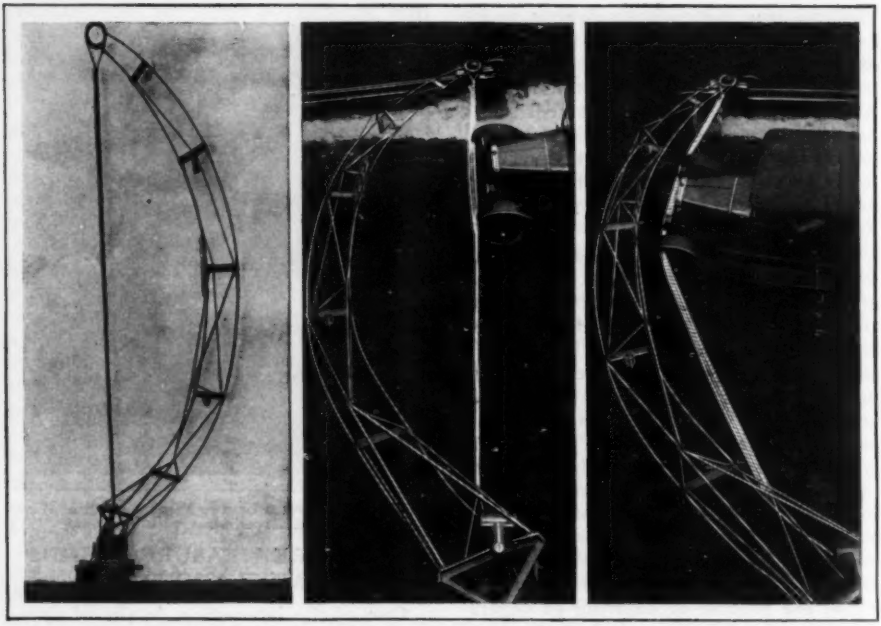
Part of the Apparatus Used to Test the Speed of Winds in Tunnel Experiments with Airplanes

HOT WIRE MEASURES WINDS IN AIRPLANE TESTS

One of the interesting details of apparatus used by the bureau of standards to gauge the velocity of winds in the test tunnels, where experiments on model airplanes are conducted, is a hot wire. It is about one-fifth the diameter of a human hair and is electrically heated. Used in connection with an amplifying set, it gives an accurate measure of the speed of the winds as they pass in waves and ripples around the planes under test.

ELECTRIC EYES REPLACE MEN AT POWER PLANTS

Power stations that run themselves and are watched by electric eyes which record their impulses miles away, are releasing men, who previously performed important but minor duties, to more active and responsible positions in the electrical world. The innovation suggests the time when television may be harnessed to aid the electrical dispatcher, but at present the method is too costly and is not practical. Essentially the same results are being accomplished by the remote-control system. Signals are sent to a central point and duplicate, on dials and in records, the readings on the instruments in the manless power plants.



Gate as It Appears When Raised; Auto Striking the Cable and Then Stopped by the Action of the Snubbing Mechanism, Which Is Visible in the Upper Part of the Two Photographs at the Right

SAFETY GATE STOPS AUTOS AT RAIL CROSSINGS

To prevent accidents at railroad crossings, a safety gate that halts automobiles before they reach the track, has been introduced. It consists of a road arm, raised and lowered like the ordinary crossing gate, but, in addition, it has a cable loop which engages a snubbing device. Should the car be driven against this loop, the cable, anchored to the snubbing post which progresses along a guide way, its movements being opposed by friction or by hydraulic means, gradually brings the automobile to a stop without injury to the driver or damage to the car. Under a test, a ten-ton truck, driven at a speed of thirty-five miles an hour, was stopped in this way without mishap.

HEATING RIVER WITH STEAM PREVENTS FREEZING

In 1776, the East river froze sufficiently to allow an army to cross the ice in safety. But the stream no longer does that near New York, for every hour some 400,000 tons of heated water and steam are sent back into the river from the big power plants along its banks. The water is used in condensing steam at the plants. Engineers estimate that the return raises the temperature of the entire stream at that point at least ten degrees in spite of the tidal currents that flow in from Long Island sound and New York harbor.

CARD HOLDER FITS ON FINGERS TO SIMPLIFY PLAYING

Persons who have difficulty in holding their cards at bridge or other games are served in a celluloid holder that is fastened to the fingers with a silk band. It permits arranging the cards easily.

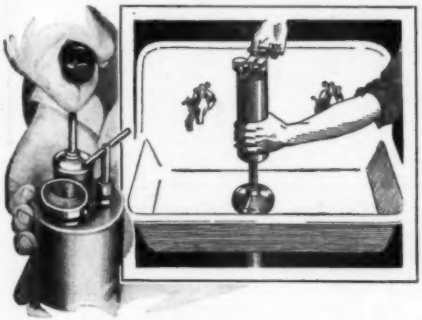
Flies have their organs of taste located in the feet.

THIEF SNARED BY BLUE POWDER SPRINKLED ON PURSES

A kind of powder that turns an indelible blue when it comes in contact with moisture, was successfully used by Scotland Yard detectives the other day in catching a thief who had been taking pocketbooks from a girls' school in London. The powder was carefully sprinkled on purses placed as decoys for the suspect, a porter at the school. They disappeared, and the employe was accused of the theft. He indignantly denied the charge, but his hands were stained a bright blue, a fact that caused him to admit his guilt. The perspiration of his hands had caused the powder, falling from the purses, to change color.

AIR GUN TO CLEAN OUT DRAINS SAVES PLUMBING BILLS

When drain pipes become clogged, an effective way to clear away the obstruction is afforded in a compressed-air gun which releases an instant blast at thirty to eighty pounds' pressure. It is pumped up by a hand plunger, a gauge at the top showing the exact pressure, and the air is released simply by lifting a trigger valve. Attachments are provided for using the gun to the best advantage in different places, such as in sinks, washbowls and other units. A reversible rubber cone makes a leak-proof connection between the gun and the drain to be cleaned. Lengths of hose can be used for insertion into crooked pipes. The device has been found especially adapted to cleaning filling-station and soda-fountain pipes.



Gun in Position for Being Pumped Up, and Drawing to Illustrate How It Is Used on Sink

Outboard-Motor Pump in Operation and as It Is Carried to Save Hauling

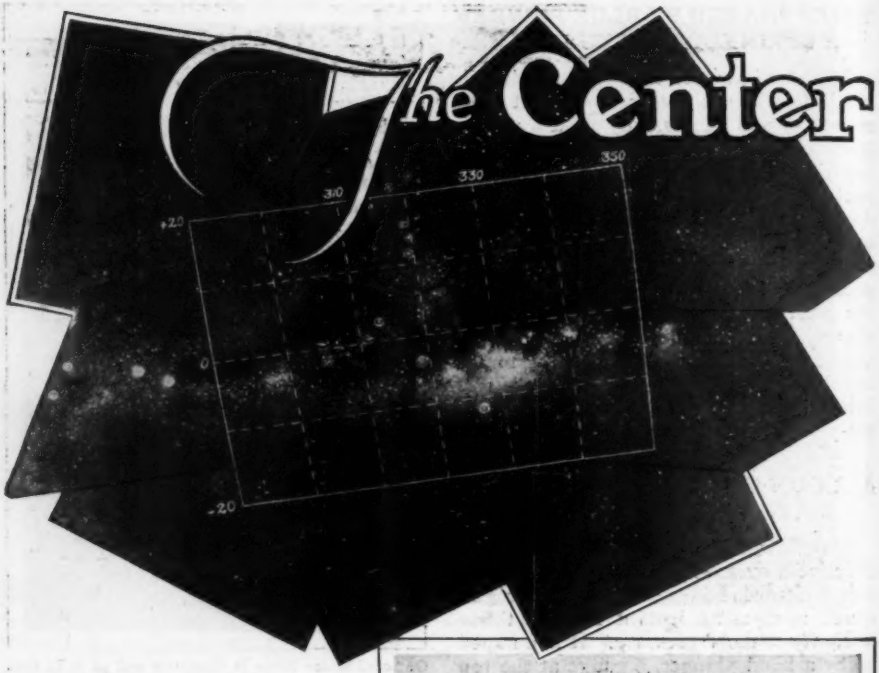
PUMP RUN BY OUTBOARD MOTOR SERVES CONTRACTORS

For draining excavations, manholes and similar work, a portable pump that can be carried on the shoulder, is operated by an outboard motor. It will pump nearly 200 gallons of water per minute, saves time and work in moving and is quickly set up. A special feature is the automatic shut-off. A safety device stops the pump when water ceases passing through it.

BOY DISCOVERS NEW EXPLOSIVE AND WINS SCHOLARSHIP

His interest in chemistry has proved valuable to Edwin Mulvaney, a Chattanooga, Tenn., high-school student. He constructed a small laboratory at home and experimented with chemicals, particularly those of an explosive nature. One of his mixtures was described to the chemical-warfare laboratories and pronounced a wholly new explosive. The boy chemist was awarded a four years' scholarship at the laboratories.

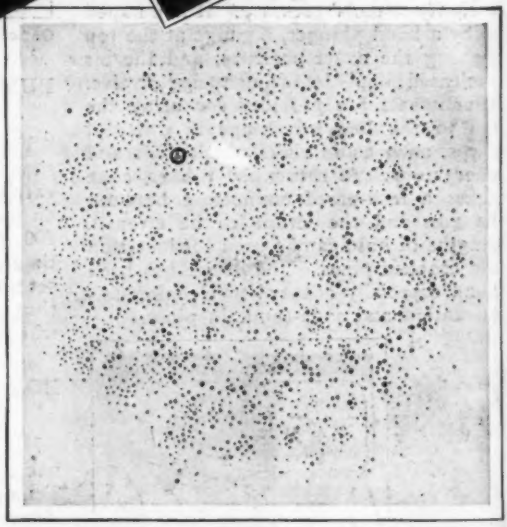
The Center



By JOHN T. BRADY

WHERE in the heavens should we look for the actual center of the visible universe, or to be more precise, the central nucleus of our galaxy, the discovery of which has been officially announced by Dr. Harlow Shapley, director of the Harvard astronomical observatory, after years of painstaking research by himself and his associates?

Can it be seen with the naked eye? How far away is it, and what are its dimensions and its composition? Is there a massive core, or nucleus, a supercenter of gravity around which our whole solar system rotates, much as the earth does about the sun? Is it an ordinary collection of bunched stars comparable with that in the vicinity of the sun, or are we in an enormous pinwheel, or spiral nebula, that is swishing the earth around through space on one of its tails, like a boy hanging on for dear life near the end of the line in a game of "snap the whip"?



Composite Photograph from Harvard-Observatory Plates, Showing the Point in Sagittarius Fixed as the Actual Center of the Visible Universe, Top, and a Diagram Showing the Universe as a Flattened Disk; the Circle Marks Our Own Solar System

For centuries astronomers have speculated on the problem of the center of the universe. It has gripped their imagina-

The Eyepiece End of a Big Telescope; This Instrument Has Been Built for an Observatory at Kembang, on the Island of Java, Where Conditions Are Good for Observation

tion much like the prospect of making gold from baser metals enthralled the fancy of the alchemists of old. But until quite recently, in fact, until Doctor Shapley perfected methods of measuring star distances photometrically and applied these methods to the problem of the distances and structures of the star clusters, the solution remained an elusive mystery.

Ancient astronomers, whose observation of the stars was limited to what could be seen with the naked eye as they tended their sheep, saw only four or five thousand altogether—hardly two thousand at any one time—and believed the earth was the center of the universe.

A natural vanity led most early speculators to this assumption, in Doctor Shapley's opinion, and it is not yet extinct. But with the development of the telescope, which enabled the scientific star gazer to probe deeper into space, sun worship began to die out in the ranks of the philosophical astronomers. Gradually they began to realize that our sun was but one of many millions of stars, and a very tiny one at that.

Then speculation as to the center of the universe began to run riot, and various celestial objects, such as Sirius and the Orion nebula, were suggested as being the central place. Measurements of the motions of stars, suggesting rotation about some central mass or masses, led, within the last century, to the notion that the Pleiades or Perseus clusters might be the controlling bodies, and more recent extensive star counts induced various investigators to locate the center in the Milky Way.

Dr. Harlow Shapley, of Harvard, and, Top, Omega Centauri, a Globular Star Cluster in the Southern Milky Way; Bottom, the Southern Milky Way Itself

Spiral in Ophiuchus
Velocity 1,200 m.p.s.
obscuring bands of dark matter which show in near-side arms of inclined Spirals
Globular clusters of extreme appearance having galactic periphery
Edge-on Spiral showing dark obscuring bands
Dark bands of Galactic Spiral which mark probable spirals near Galactic Plane
How the usual two coiled Arms radiate from opposite sides of the bright Nucleus
Farthest Globular Cluster 220,000 L.y.
Nearest 11,000 L.y.
SUN
Four-branched Spiral
Multi-branched Spiral
Embryo Spiral without condensations

Copyright, S. W. Clatworthy

Diagram of the Universe; the Abbreviation "L. Y." Means Light Years, the Distance Light, Traveling at 186,000 Miles a Second, Will Go in One Year; This Is the Astronomers' Measuring Unit

Doctor Shapley carefully explained that he had discovered the nucleus of only that universe with which astronomical science is familiar and which it can measure at the present time, or in other words, the center of one particular comprehensible universe, and not the center of centers of all stellar creation.

So he describes his discovery as the nucleus of that group of stars of which our sun is one infinitesimal member, and which doesn't include the tens of thousands of other universes that lie beyond the limits of our galaxy.

"Really what we have found," he went on, "is the central nucleus of a large, very much flattened cookie-shaped system, somewhat irregularly circular, that is composed of perhaps 30,000 million suns. That's the best numerical estimate we have, but I think the actual number is very much above that figure. And sprinkled around among them may be any number of planets which we cannot see.

"Our sun then is one of about 30,000 million stars that form a great organization called the galaxy, and the planets, such as the Earth and the others that we see in our solar system, are a very insignificant part of it.

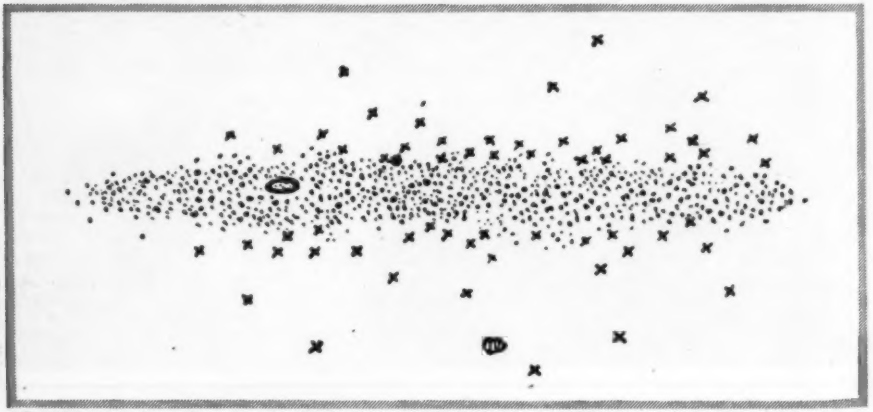
"When we begin thinking about finding the center of the galaxy, therefore, we are faced with a curious problem, for here we are on a tiny little planet going around a dwarf star, and as we look out into space, we see stars in all directions, the nearest one to us being our sun, 93,000,000 miles away, and it is twenty-five trillion miles from our solar system to the nearest star."

Doctor Shapley took up this problem in 1915 while he was attached to the Mt. Wilson observatory, at Pasadena, Calif., prior to coming to Harvard, and the method he developed then of measuring star distances photometrically introduced a revolution into the concepts of the universe and paved the way to the discovery of the center of our galaxy. At that time, the diameter of the Milky Way was estimated at 20,000 light years and our sun was thought to be near the center of it.

Realizing that the globular star clusters, which are especially numerous in the southern Milky Way, would be of much importance in studying organizations of the higher orders, and particularly useful in helping to measure the dimensions of our star system, Doctor Shapley first undertook to measure the distances of about seventy of them, all that were then certainly recognized.

And in studying the famous star cluster in the constellation Hercules, known as "Messier 13," for example, he found its distance to be about 35,000 light years from the earth. Small stars among the 50,000 in this group were found to be 100 times as large as our sun, while the more brilliant were a thousand times as big as Old Sol.

"All of the globular clusters were found to be immensely remote," he explained, "and at the same time their distribution is



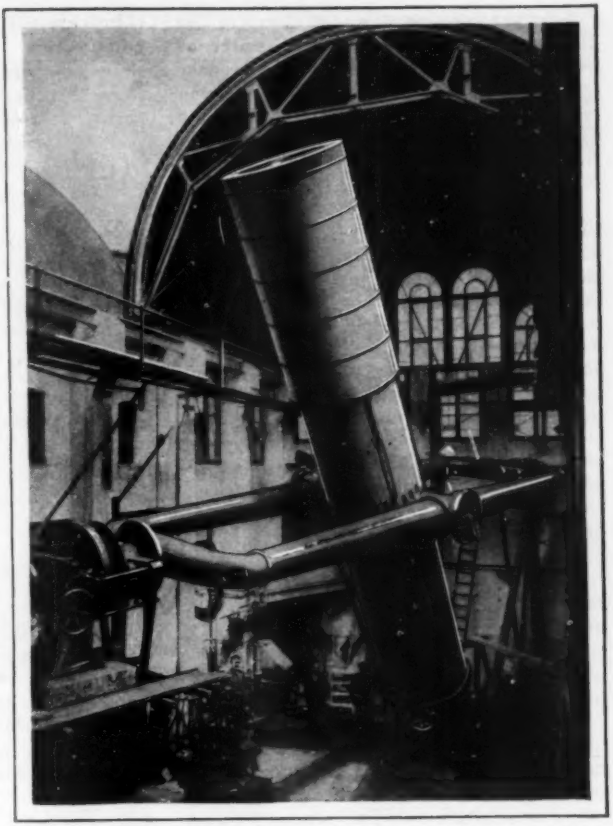
Our Galaxy as Seen Edgewise, the Small Circle at Left Marking Our Solar System; the Crosses Represent Globular Star Clusters Outside Our Galaxy, as Diagrammed by Doctor Shapley

such that we can derive from it the form and extent of our whole star system, since they are certainly part of our galaxy, and probably outline the whole system of thousands of millions of individual stars. The most remote of these star clusters is so deep in space that light from it requires 2,000 centuries to reach the earth, notwithstanding its inconceivable speed of over 11,000,000 miles a minute.

"Analysis of the distances and distribution of the globular star clusters indicated that they form a greatly flattened, irregularly assembled stellar system, and that our sun is not in the center of it or anywhere near the center, but halfway toward the outer edge.

"I got a distance of 200,000 light years as the diameter from one edge to the other, and all my measurements and the high concentration of the globular clusters in the constellation Sagittarius (The Archer) intimated that the center was in that region. In order to check up on this, I started, here at Harvard, several years ago, a systematic investigation of the variable stars in a belt twenty degrees in width. To cover thoroughly the Milky Way, we divided it into 240 fields, and ever since, night after night, we have been photographing it with four telescopes. The study of these plates will enable us to measure the distances of the variable stars, and a knowledge of their distribution in space will give us more light on the structure of our own galaxy.

"About three-fourths of all the variable stars ever discovered, by the way, have been found by Harvard observers, and the total was only in the neighborhood of 5,000 up to about a year ago. But within the last year we have found about 1,000 new ones. We expect the search to go on for ten or fifteen years before we have found all the variables.



The New Twenty-Four-Inch Telescope for the Javanese Observatory at Kembang Has a Six-Foot Tube, Forty-Six Feet Long

"One of the first results of our concentrated effort to fathom the depths of the Milky Way came when, with the able assistance of Miss Henrietta Swope, we found a heavy concentration of stars in the constellation Sagittarius at a distance of 47,000 light years from the earth.

"Already a dozen or so clouds or clusters of the remote Milky Way have been found on the Harvard plates, one of which shows a special cloud of nebulæ in the constellations of Coma and Virgo, off 10,000,000 light years from our galaxy. Its center is the center of one of the universes of universes.

"But the solution of the mystery of the direction and distance to the center of centers—to that remote point in space which is the center of gravity for all the tens of thousands of galaxies—will have to await the completion of our nebular survey which will take from ten to fifteen years more; and it may never be solved."

There is pretty good evidence to show that our whole solar system is rotating about the nucleus in Sagittarius, according to Doctor Shapley, and he is supported in this view by conclusions drawn by observers all over the world. Doctor Shapley estimates the speed of rotation at about 200 miles a second, and looked at from the north side, the direction of rotation is clockwise.

Unfortunately the actual central point of our galaxy, as determined by Doctor Shapley, is hopelessly obscured from our vision by impenetrable clouds, he explains, but if you are curious to see how it appears to the naked eye, look for it in the southern Milky Way at a point where Scorpio, Ophiuchus and Sagittarius corner together. In the spring, it will be seen due south in the early evening.

"What we seem to have found," continued Doctor Shapley, "is definite evidence that the Milky Way has a massive nucleus composed of billions of stars located in the direction of Sagittarius, but so large that it flows over into Scorpio and other constellations. This nucleus has a diameter of probably 25,000 light years.

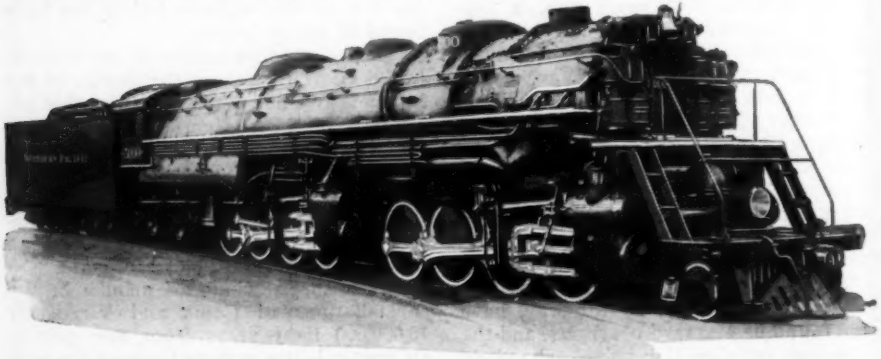
"But beyond the limits of our star system, nebulæ are scattered through space. They turn out to be other stellar systems, comparable to our galaxy in form and composition. There are hundreds of thousands of them, mostly too far away to be accurately measured, but apparently smaller than our system."

AUTOMATIC BRAKE FOR AUTO PROMOTES SAFETY

Brakes are applied automatically as soon as the foot is removed from the accelerator in a safety system a Swiss inventor has developed. The brake is on when the car is in neutral gear, but is released with the shift to first and operation of the accelerator. It is said to hold the car on hills without the use of the handbrake and is intended to be of great service in the event of danger ahead. Few drivers forget to take the foot from the accelerator in case of trouble, but not all know how to stop the car promptly after that.

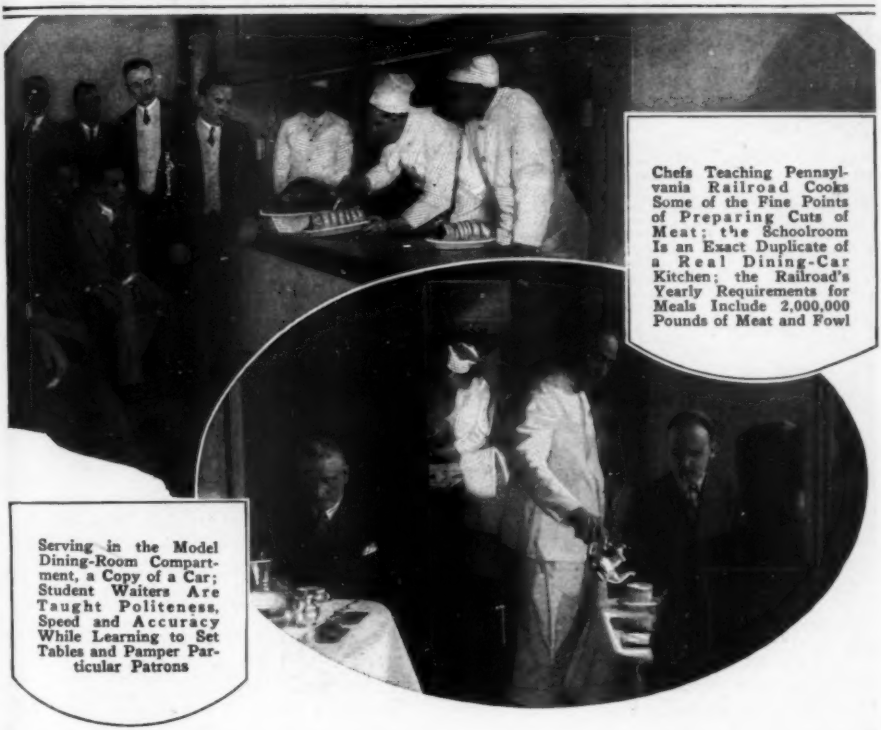
ENGINE HALF A BLOCK LONG HAS THIRTY-FOUR WHEELS

Designed especially to burn a grade of coal of comparatively low heating value, a huge engine constructed for the Northern Pacific railway is 125 feet long, weighs more than 1,000,000 pounds and has thirty-four wheels, including the twelve on the tender. An interesting feature is the mechanical stoker which will crush, deliver, and distribute about the huge fire box, more than twenty-two tons of coal an hour. It is expected that the locomotive will be able to haul, in one train, cars that are now made up into two.



Powerful, Huge and Yet Easily Managed, This Locomotive for the Northern Pacific Railway Is Especially Interesting Because It Has Been Designed to Burn a Low Grade of Fuel

DINING CAR WITHOUT WHEELS SERVES AS SCHOOL

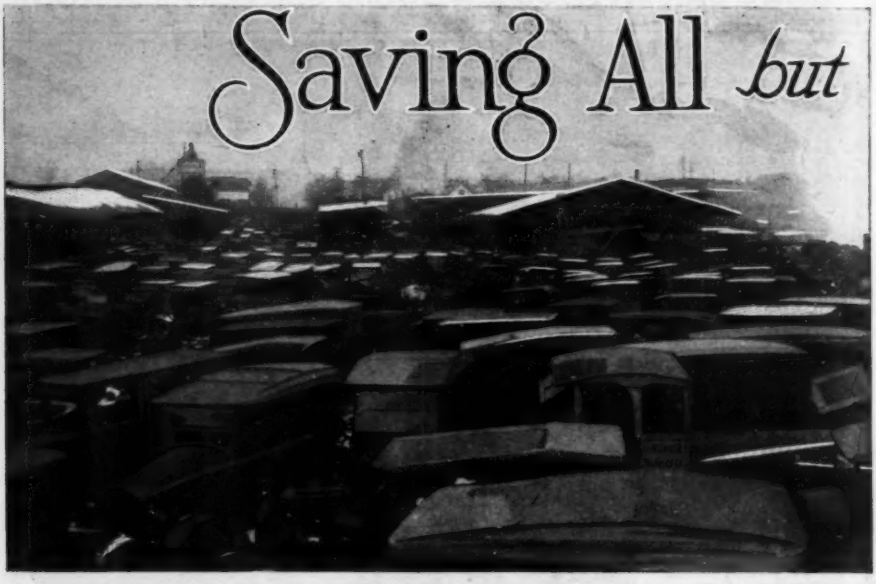


Chefs Teaching Pennsylvania Railroad Cooks Some of the Fine Points of Preparing Cuts of Meat; the Schoolroom Is an Exact Duplicate of a Real Dining-Car Kitchen; the Railroad's Yearly Requirements for Meals Include 2,000,000 Pounds of Meat and Fowl

Serving in the Model Dining-Room Compartment, a Copy of a Car; Student Waiters Are Taught Politeness, Speed and Accuracy While Learning to Set Tables and Pamper Particular Patrons

To train cooks and waiters under conditions resembling, as nearly as possible, those encountered on an actual run, the Pennsylvania railroad has built exact duplicates of dining cars in three commissary buildings and now maintains schools at New York, Columbus and Chicago. Every feature, from cooking utensils, range, broiler and pantry, to the dining room and table for patrons, has been reproduced precisely. Even the familiar aisles and corridors have been retained and made to conform exactly with the standard dining-car specifications. In fact, everything is almost exactly the same except that the stationary school does not move. But, officials declare, after waiters have been trained in a schoolroom of the same proportions as the place in which they are later to work, they have less difficulty in balancing trays and passing around corners, even when the car is crowded and the train is speeding around a curve. The average dining-car employe spends about three hours at school each week while assigned to his regular run. At intervals, he is detailed to the school for a week or more of intensive training. Under a staff of specially trained instructors and supervisors, cooks learn how to prepare various cuts of meat, and poultry of all kinds; how to make sauces and dressings, and they become familiar with the special utensils used on a dining car and also become accustomed to working within the restricted space afforded in a dining-car kitchen. The schools have been established largely because of the railroad's extensive dining-car operations and the difficulty of giving instruction in an ordinary kitchen or schoolroom. The line now has 183 dining cars which serve an average of 12,000 meals daily, or approximately 4,000,000 a year, and are using 2,500 tablecloths and 15,000 napkins every day the year around.

Saving All *but*



Corner of a Graveyard for Motor Cars That Have Outlived Their Usefulness in St. Louis; No Car That Enters the Yard Leaves Again under Its Own Power

A NEW style of establishment for the efficient disposal of aged automobiles which menace public safety has been fostered by the organized motor-car merchants of St. Louis.

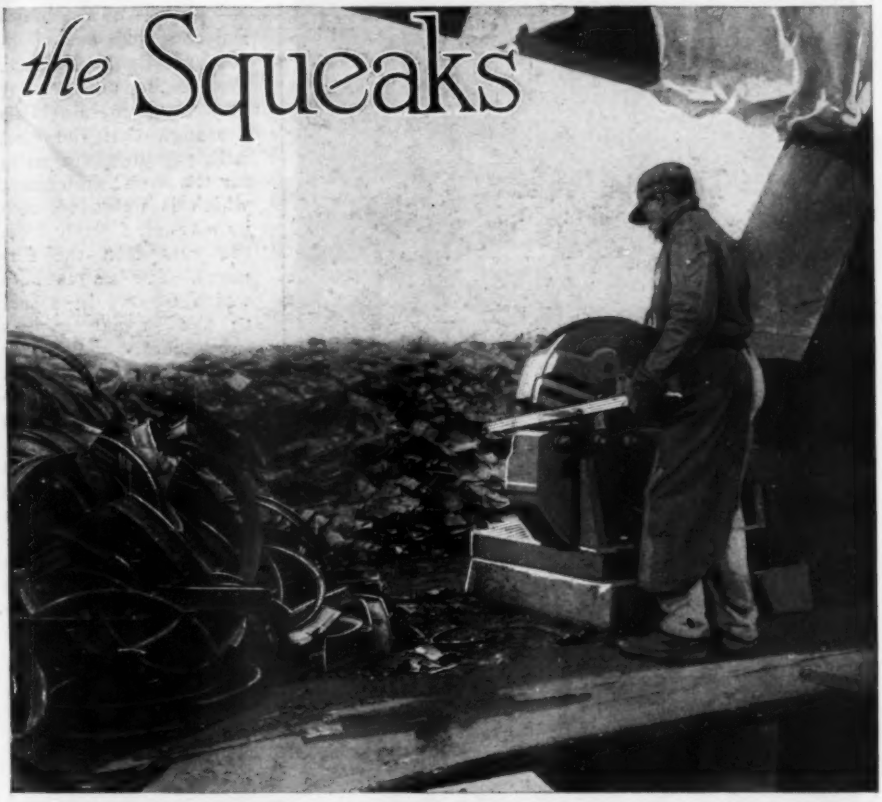
These dealers have banded together in a traffic-safety campaign to eliminate veteran cars with defective brakes, steering controls, and similar imperfections, from arterial highways and intersecting streets. Their co-operative undertaking plant is an efficient salvage station where all but the squeaks and rattles from old cars are reclaimed.

This salvage station is quite different in operation from the ordinary automotive junk yards. Its rigid rule is that every car purchased must be dismantled. The majority of the cars are delivered at the plant under their own power, but that trip is their touring swan song. Dilapidated automobiles are purchased by the thousand both from the dealer members of the association and from the general public. The prices paid range from $2.50 to $40, the average automobile being bought for $20. The salvage is so complete and detailed that $40 worth of accessories, repair parts, equipment and raw manufacturing materials will be recovered from each machine and sold.

The plan not only accomplishes its primary purpose of ridding the congested streets of dangerous cars, but it brings this to pass at a profit. The salvage yard has fixed $100 as the minimum price for used cars which the reputable dealers will handle. They hope to raise this limit to approximately $200 during the next year. All cars of lower value are catalogued as unsafe, and are delivered to the salvage station as automotive "sacrifices."

The batteries, generators, starters and radiators are removed from the cars, inspected and tested. If found in good order, they are reconditioned and sold directly through the retail shop connected with the salvage plant under a ninety-day guarantee. These parts usually are in fine serviceable condition even though removed from worn-out machines, because they are replaced periodically and maintained better than the millrun of working parts in the old automobile.

In wrecking the cars, the windshields as well as the window glass in closed cars



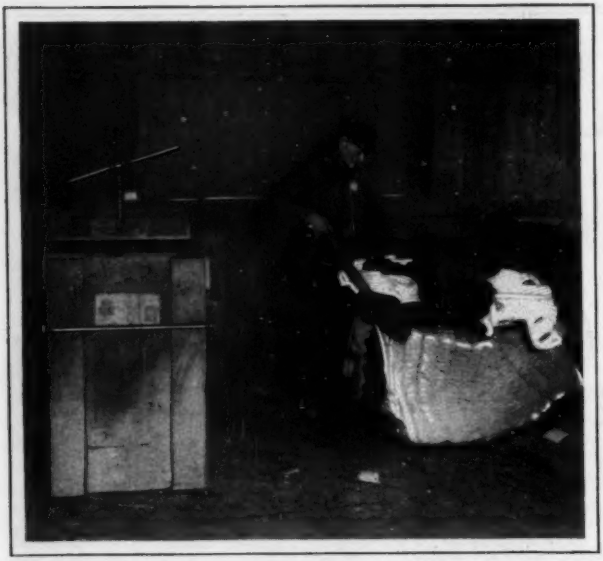
One of the Powerful Electric Shears That Bite Ancient Automobiles into Small Pieces, Ready to Be Melted Down and Used Again; It Is Working on a Pile of Rims

are removed, sorted and graded as to size and model of auto which they will fit. The ordinary junk man rips all upholstery from the car and burns it. The St. Louis wrecking establishment reports attractive returns from the salvaging of moss, hair, cotton, burlap and leather from upholstering. This project pays the entire expenses of its acetylene-torch shop, where the motors are removed and the chassis dismembered.

An electrified monorail system removes the motors from the torch shop and delivers them to the yard unit, where they are scrapped in order to recover the different metals they contain. Bronze, high-carbon steel, number-one melting steel, bearing metal, copper, aluminum and cast iron, which are sold for from seven to twenty cents a pound, are reclaimed from the engines.

Some bodies are removed and sold intact for from $25 to $50 apiece, but the majority of bodies, fenders, steel tire rims, rear axles and other worn-out parts are chewed into smelter material, called "busheling," in the jaws of mighty electrified shears. When working at capacity, one of these shears will reduce fifty ordinary automobile bodies, fenders and other discarded equipment into metallic mincemeat in one day. This busheling sells for an average price of $8 a ton.

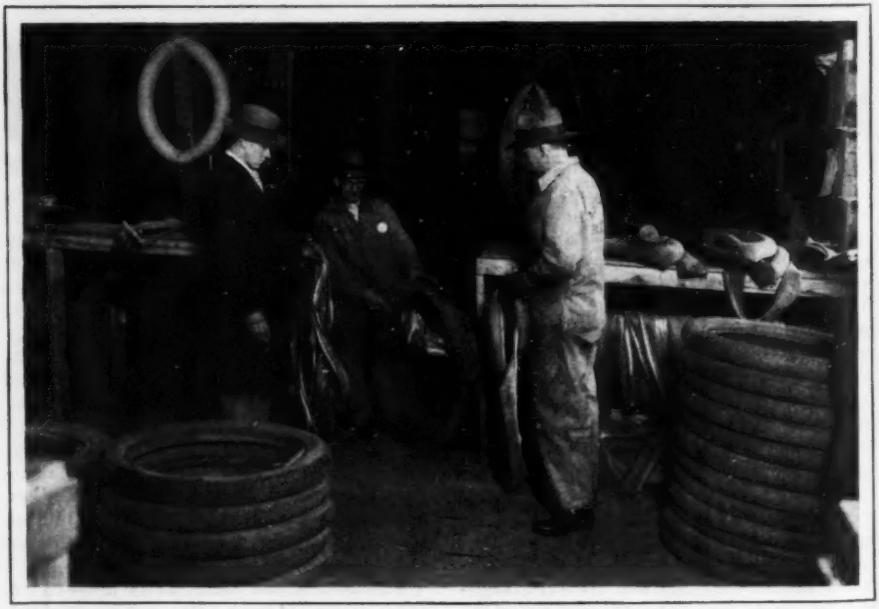
The macerated material is allowed to accumulate in huge piles until some ten carloads of the junk are ready for ship-



Hair, Cotton, Moss and Leather Are Salvaged from Upholstery, and the Profits Run the Acetylene-Torch Shop

ment to the smelter. A powerful electro-magnet is used in loading the scrap on flat cars. This magnet lifts 500 pounds of the material at a time and eliminates costly hand labor. The sorting and grading of salvage metals is so thorough that the steel mills pay premium prices for the metal mincemeat which is unloaded, also by magnet, directly from the cars into the furnaces. The automobiles which owners have sold to the salvage experts subsequently may come home again to roost in the form of new radiators, boilers, bathtubs or plumbing fixtures.

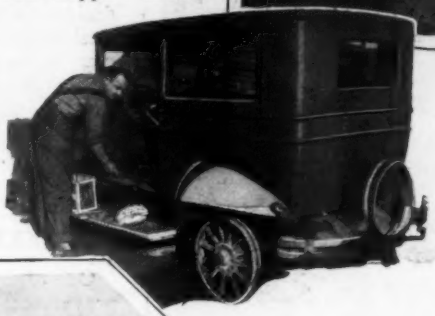
Building contractors buy old automobile springs by the ton from this St. Louis salvage enterprise. The springs subsequently serve as ideal reinforcement for new concrete construction and are in keen demand for that



Tires, Batteries and Generators, Along with Other Kinds of Parts, Are Salvaged and Resold for Further Use; Thousands Are Put Back on the Roads Each Year

purpose at $20 a ton. Everything else that is merchantable is also reclaimed and sold. Repair parts for practically all types and models of American and some foreign automobiles are obtainable at low prices at this hatchery of new automotive trade ideas.

Its originators hope to see this St. Louis scheme of co-operation in the salvaging of venerable and crippled motor cars flower into a national organization. This body, as visualized in motor-world day dreams, would be the country-wide core of chains of salvage stations which would speckle the American map. If every large city supported such a co-operative plant, it would not take long to exterminate unsafe motor cars from the traffic picture.



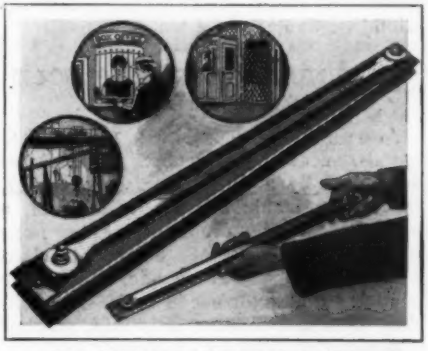
Closed Bodies, if in Good Condition, Are Resold at From $25 to $50 Each; Bottom, Portable Torches Cut Up the Scrap

Such a project would also aid in standardizing and stabilizing used-car values and would force out of business the fly-by-night sandlot dealer who barters in "anything and everything that will run." Of the 25,000,000 automobiles now in use in the United States, at least one-sixth are possible "death cars" that are unsafe to operate in city-speed congested traffic or in open-country running, where many drivers travel at racing speed.

The menace of these roving automobiles — breeders of future tragedies — must be faced and then effaced from county, state and national highways. The St. Louis plan at least is a stepping stone toward this goal until some better plan, if any, is devised.

ELECTRIC HEAT "BY THE FOOT" REPLACES STOVE

For warming small rooms and restricted spaces, an electric heater in the form of a slender bar, two feet long, has been introduced. It is thoroughly insulated, can be installed almost anywhere and operates with direct or alternating current. It is especially adapted for service in watchmen's houses, garages, vaults and show windows, and may be used singly, in pairs or in groups, as required.



Electric Heater, and Illustrations of Uses

Spraying Man with Gas That Freezes Fires; It Causes No Damage to Fabrics When It Dries

FREEZING GAS CURBS FIRES AND REDUCES DAMAGE

Improved apparatus has been developed by several fire departments for the use of carbon-dioxide gas in extinguishing blazes. This vapor freezes as soon as it is released from its containers and, by lowering the temperature of the surrounding area and cutting off the oxygen supply, is effective in putting out fires. When it melts, it entirely disappears without leaving a stain and is therefore especially suitable for use in quenching fires in stores and other places where the goods would be damaged by water.

ALUMINUM MIXED WITH GOLD AIDS DENTAL WORK

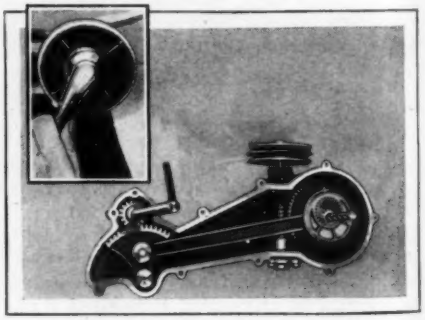
Aluminum is combined with other metals, according to reports of processes developed by a San Francisco inventor, to form valuable alloys. With gold, a hard, light alloy is prepared; a silver mixture so hard that it can be sharpened to a razorlike edge is also made, and copper is made suitable for use in tools. The gold alloy does not oxidize, it is said, making it especially useful in dentistry.

FILTERS SALVAGE COAL DUST FLOATING ON RIVER

Coal dust, floating on the river Ebbw, which flows into the Bristol channel in England, is to be reclaimed and used for heating purposes, by installing settling tanks and filters where the stream drains the land around the mines. Besides purifying the water, the plan is expected to make available considerable quantities of fuel at prices lower than the present scale for grades of corresponding quality.

SPEED-SHIFT WASHER DOES BETTER WORK

One of the most interesting improvements in washing machines is an electrically operated outfit that has a speed-shift arrangement which requires no clutch or gear mechanism. Its speed is regulated simply by turning a small handle. The machine can thus be used more efficiently for washing different fabrics, some being cleansed better at low rather than high speed and not so likely to be torn. Furthermore, the speed shift prolongs the life of the washer and the absence of a clutch and other bothersome mechanisms is a great convenience to the housewife. The washer is the invention of an automobile engineer and is in line with similar improvements being developed for cars to eliminate gear shifts on them.



Cross Section, Which Shows Gear-Change Plan, and, in Insert, the Control Handle

"BARN-DOOR" MILL HARNESSES THE DESERT WINDS

View of the Entire Mill, and One of the Blade Units, Showing Size and Arrangement

Travelers near Fresno, Calif., are sometimes startled to see what appears to be a number of barn doors flying through space. Closer examination shows that the rig is a sixteen-bladed windmill which a Dutch inventor has devised to run two pumps and a dynamo at the same time. Oddly enough, a barn door was the inspiration for the idea. The inventor once watched a ranch hand trying to close a barn door against the wind. The difficulty of the task prompted the plan of building a mill with large, flat blades like those of a paddle wheel. The idea was developed, the blades being arranged to turn a shaft which was geared to the pumps and the dynamos. An advantage of the scheme at this particular farm is that the mill is placed where no obstructions reduce the force of the wind so that a high tower is unnecessary. At the same time, the inventor has devised a way to decrease the resistance from the back stroke of the blades by erecting a wooden wall which covers the lower part of the mill at the rear. Under favorable conditions, the rig is said to be the equivalent of a fifty-horsepower plant. A steady stream of water is afforded by the two pumps.

RADIO RECORD ON DICTAPHONE SPEEDS NEWS REPORTS

Radio and the dictaphone have been linked in Oregon to speed the distribution of stock-market reports. The radio voice is recorded directly on dictaphone cylinders from which a stenographer prepares copy for the newspaper presses. The experiment was successfully performed under the direction of the state agricultural college to insure the speedier distribution of market reports throughout the rural districts, and adaptations are contemplated to make possible the continuous recording of similar broadcasts.

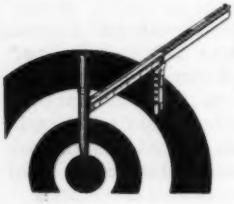
Model of Proposed Hotel for Lake Resort; the Boatlike Plan Permits Wide Promenades and a Good View

BIG HOTEL IN FORM OF BOAT FEATURES LAKE RESORT

Modern ideas predominate in a hotel a German architect has designed for erection in one of the lakes near Dortmund. It is to be built in the form of a boat and has wide promenades like inclosed decks, a coffee terrace, dance pavilions and large dining rooms overlooking the water, besides the usual hotel rooms. A special feature is to be the illumination both inside and out. At night, rays from thousands of electric lights will make the hotel visible from great distances. A fine view is enjoyed from most windows.

SLIDING-BEAM COMPASSES PROMOTE ACCURACY

Designed to eliminate the faults most frequently found in ordinary compasses, a new instrument is made in the form of beam compasses, but small and light enough to be used with one hand. It is claimed that the point of these compasses will not slip and tear the paper, and the adjustments are such that no small errors can occur in setting or in frequent use. The instrument will draw circles up to eight inches in diameter.

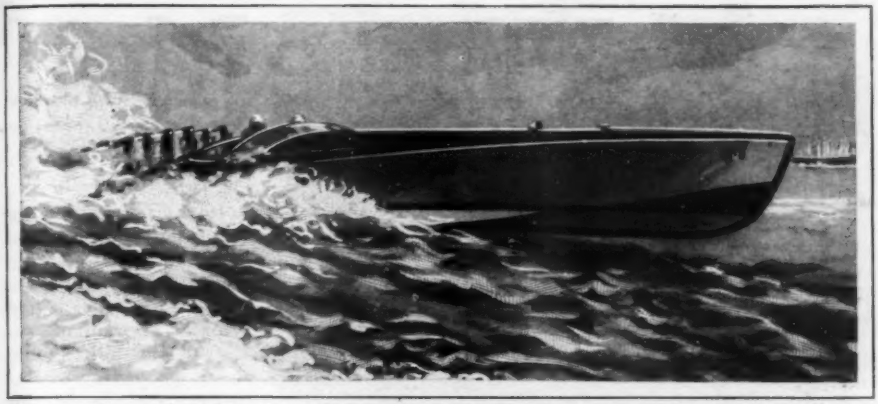


FORTUNES THROWN AWAY IN LITTLE THINGS

By stopping leaks in faucets, New York city saved 400,000,000 gallons of water in one year. Gas companies estimate that tiny leaks in jets and mains cause a loss of millions of cubic feet of gas each year, and an English expert declares that some 4,000,000 bottles of medicine are wasted annually because the average teaspoon holds more than the usual dose. An engineer has estimated that it takes 2,434,026 tons of coal yearly to generate steam enough to blow the whistles on the railroad engines in the United States and that more than a million pounds could be saved if the whistles were moved slightly forward and adapted to a single high-pitched note. In England, 70,000,000 telegram blanks find their way into the wastebaskets every year.

SAFETY THROTTLE FOR AUTOS HELPS SAVE GAS

Greater safety in driving, economy in gasoline, and convenience are some of the advantages claimed for an accelerator-control throttle attached to the gear-shift lever. It permits shifting from one speed to another without removing the foot from the brake pedal, prevents killing the motor and provides the "extra arm" so often needed while driving in crowded traffic. The device is attached in a few moments, and no alterations in the car are required. It provides an easy way of operating the accelerator by hand instead of by foot control and at the exact time when more gas is needed.



With the Engine Placed behind the Driver and His Mechanician, the New English Speed Boat, Which Is Coming to America to Race, Presents an Unusual Departure in Design

ENGINE IN EXTREME STERN OF NEW SPEED BOAT

A twenty-six-foot hydroplane, powered with a 900-horsepower 12-cylinder Napier airplane engine, is being brought to America by Maj. H. O. D. Segrave, the famous racing-car driver, to attempt to lift the world's speed record on the water He is bringing his new racing car, the "Golden Arrow," to attempt the same feat on land. The unusual feature of the boat is that the engine has been placed in the extreme stern, with the pilot and mechanician in front of it, reversing the usual arrangement. The position of the engine is expected to increase the planing action of the one-step hydroplane hull at high speeds. The engine is similar to that in his racing car, and is the same type that was used to win the Schneider cup from Italian flyers last year at Venice. Reports from England rate the boat at over eighty miles per hour, but this speed will have to be exceeded to better the record set at Detroit last September, when Gar Wood's "Miss America VII" averaged 92.834 miles per hour in six one-mile dashes.

ALL UNDER THREE FEET RIDE FREE IN BUSSES

Height, not age, is to be the determining fare factor on an eastern motor-bus line. All persons thirty-six inches tall or less, will be carried free. Those taller will pay the fare regardless of their age. To prevent disputes, a height gauge has been installed on the doors of the vehicles. Children whose heads overtop the mark must pay.

LOUD SPEAKER FOR TELEPHONE LEAVES HANDS FREE

To amplify the voice from the telephone, a loud-speaker attachment has been devised so that the listener does not have to hold the receiver. An arrangement is also provided whereby the hookup may be connected with a radio combination on the telephone instrument.

Telephone Conversation Being Amplified through the Loud Speaker Attached to Receiver

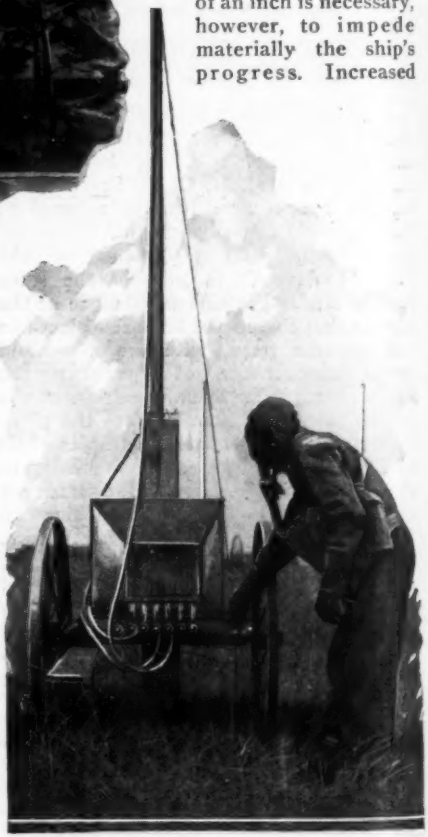
Where Men

By C. MORAN

MEN who eat corn mixed with liquid titanium tetrachloride, a chemical used to make military smoke screens; who subject themselves to the deadly carbon monoxide of automobile exhausts; who handle chemicals, a single drop of which eats flesh to the bone, are experimenting at Edgewood arsenal, Md., in the production of new war gases and chemicals and in the utilization of these elements in industry.

Recent research at this laboratory has shown that the useful life of rubber may be prolonged by treating it with certain anti-oxidants; that the minute, natural "one-man tanks" of the seas—the marine borers—which have sent to the bottom more wooden ships than all the guns of war, can be halted by Lewisite, a deadly warfare chemical.

A toxic paint has been developed to prevent the formation of barnacles on the hulls of ships, which cause an annual loss of $75,000,000 in fuel alone. Barnacle is the term commonly used for all marine organisms which attach themselves to the bottom of ships, but the barnacle itself is but one of a number of such organisms, although the principal one. These growths accumulate rapidly on the hulls, sometimes projecting many inches. Only a fraction of an inch is necessary, however, to impede materially the ship's progress. Increased



Testing Poison Gas on Plants at Edgewood Arsenal, and Field Truck Used to Measure Gas Content of Air; It Is a Complete and Compact Gas Laboratory and Does Away with the Chance of Errors

Defy Death

fuel consumption of a vessel handicapped by barnacle growth sometimes amounts to twenty-five per cent.

Every vessel must be drydocked periodically for barnacle cleaning, the frequency of such cleaning depending upon the service of the vessel as to seasons and latitudes. The marine growth is active during the entire year in the tropics and only during the summer in the temperate zones. The paint devised by the war chemists is being used on destroyers in final tests to determine the relative life and cost of hot plastic paints and cold varnish paints.

Not a Spiderweb but a Hemispherical Vision Chart, Used to Measure Angle of Vision of Various Gas Masks

The erroneous idea seems to be quite prevalent, say these chemists, that all chemical agents of warfare are toxic. In a recent demonstration, a smoke curtain was dropped from an airplane which was passing over a cornfield. Some of the liquid titanium tetrachloride fell on the leaves and ears of corn which subsequently became discolored. The farmer claimed that his crop had been damaged and demanded reparation.

A number of the more discolored ears were sent to the arsenal for test, and it was disclosed that neither liquid titanium tetrachloride itself, nor the products formed when it produces smoke—hydrochloric acid and titanium oxide—are harmful to eat. The discolored ears were eaten without producing any bad effect and the same was true with grains of corn mixed with a small quantity of titanium tetrachloride. All the discolored corn was purchased and fed without injurious results to the live stock at the army post adjoining the cornfield.

The pestilence of certain species of birds which are harmful to agriculture or which deface buildings has long been the subject of investigation by the biological survey. Recent experiments have been made in endeavoring to exterminate these species by the use of chemical gases, but curiously enough the birds emerged from the gases unhurt. It was found that birds have rather marked resistance to toxic gases, and furthermore, that it is difficult to build up, out of doors, sufficiently high concentrations of these gases to be effective over extended areas.

During the war it was noted that pigeons almost always returned to their cages safely when liberated in a gas cloud. This

Fumigating a Bakery Badly Infested with Flour Weevils; Deadly Poisons, in Bags, Are Dropped into Jars Containing Another Poison to Create the Clouds of Lethal Gas

was quite a mystery until it was realized that the pigeons escaped by rising quickly above the gas. The tests showed that crows attempt to fly out of the gas cloud in the same way as soon as its irritating effects are felt.

Methods of extending the life of rubber many times its normal life have been developed as a result of experimentation to prevent the rapid deterioration of the hose tube, facepiece and exhalation valve of gas masks. Such deterioration made difficult the problem of maintaining a war reserve of gas masks. Initial tests revealed that methods of curing rubber had an important effect upon its life. Undercured stock, lacking sufficient sulphur, becomes soft and even sticky with age, while overcured and bloom stock, containing an excess of sulphur, becomes brittle and cracks. As a result of the tests, faulty cure has been corrected and facepieces are now molded individually. This has developed an increase of the useful life under normal storage conditions from a few years to approximately thirty-five years.

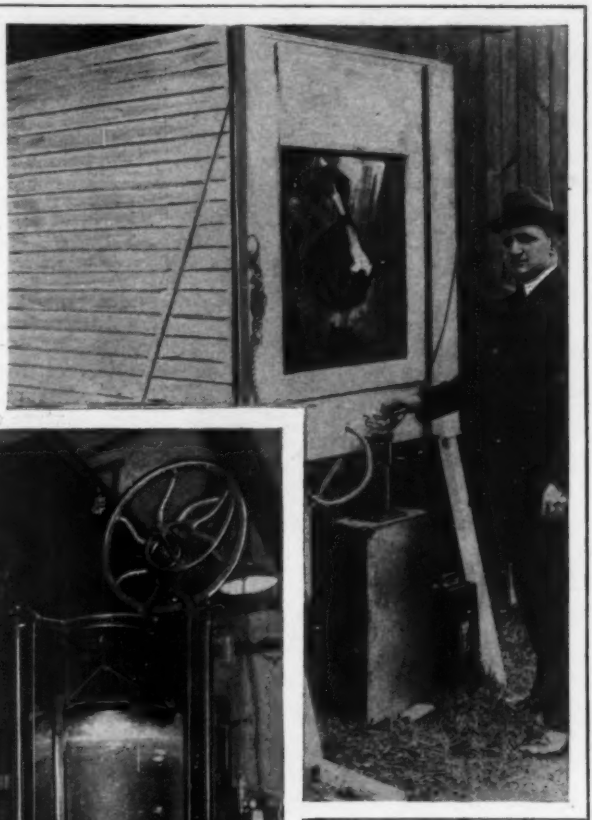
Another improvement in rubber has been developed with anti-oxidants. These chemicals, when incorporated in rubber compounds, materially reduce or retard rubber deterioration due to oxidation. Tests indicate improvement that may prolong the useful life of rubber to sixty years. For protection against sunlight, a compound has been developed of rubber, pigments, dyes, and softeners dissolved or dispersed in a suitable solvent. Methods of storing gas masks in inert atmosphere, such as nitrogen, also have been devised.

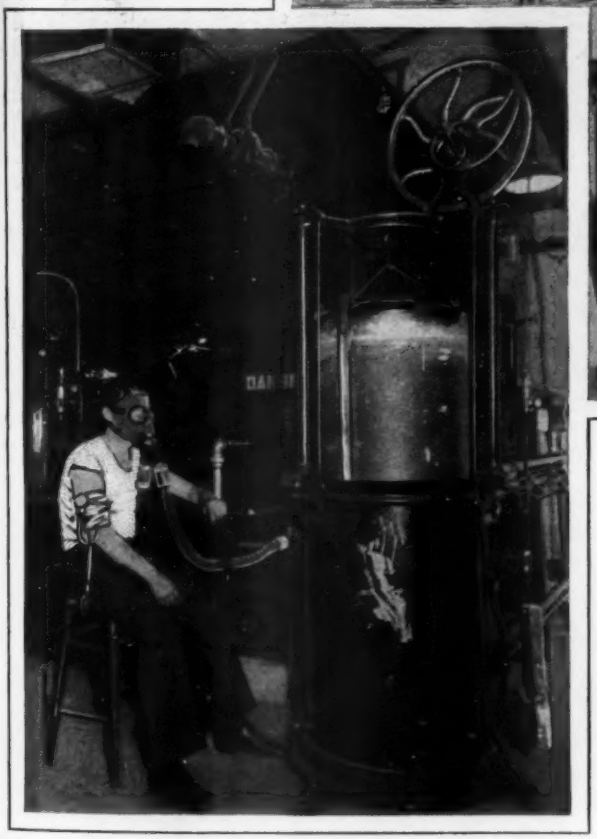
The marine borers have been halted by Lewisite in the hands of the government chemists. Indications are that battles, started long before the sinking of the Spanish Armada, now have been brought to an end by the application of a derivative of Lewisite in the path of the disastrous marine borers, such as the teredo, bankia, martessa and limnoria.

These mollusca and crustacea have been recorded in history as being responsible for the sinking of many ships of the Spanish Armada and of boring to weakness the timbers of the dykes of Holland, and they have caused millions of dollars of damage to the wharves of the world by eating the wooden piling.

Creosote long has been applied as a temporary barrier to these pests, but for many years the war-department chemists

have been experimenting upon a more permanent defense. Tests have been completed to show that organic compounds of arsenic, mercury and copper have been of the greatest general toxic value against the marine borers. Of the arsenicals tested, those which were either chemical agents of warfare or derivatives of these chemicals were most effective. A derivative of Lewisite—chlorvinylarsenious oxide—





Apparatus Used to Test War Gases on Human Beings, and, Above, One of the Side-Line Developments; Treating a Race Horse with Chlorine as a Cold Cure; the Gas Treatment Is One of the Accidental Discoveries of War Days Which Has Proved Successful in Peace

has the highest toxic value.

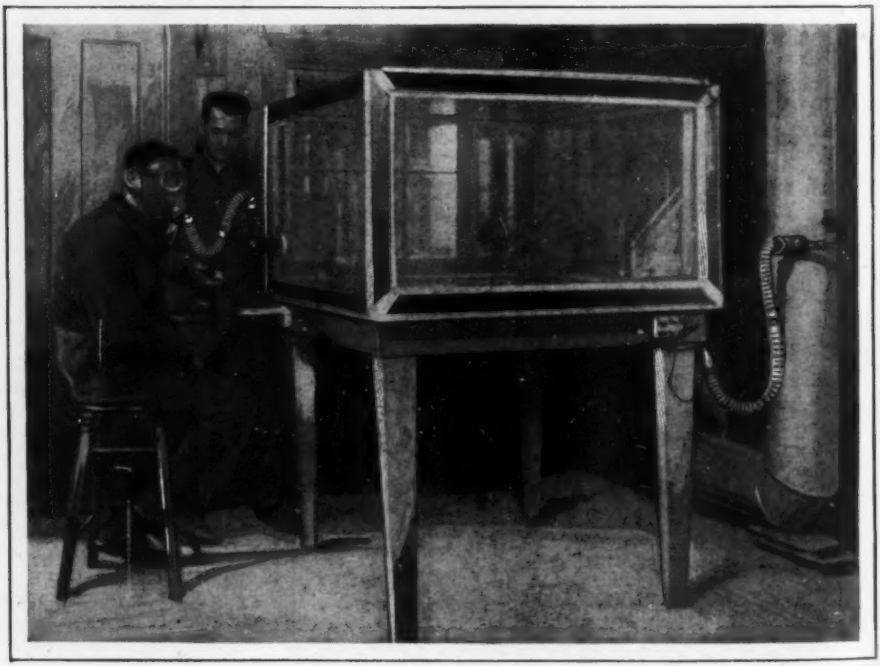
Solutions of the following compounds in creosote have stopped the borers from passing into the treated portions of test piling after they had riddled bait strips attached to the piling: copper orthonitrobenzoate, mercury benzoate, mercury resinate, mercury stearstemdiphenylamine-chlorarsine. Straight creosote impregnations did not stop the borers.

Following a recent explosion in an Alabama coal mine, eight men

Testing the Tensile Strength of Rubber Treated with Chemicals That Prolong Its Life to Sixty Years

were trapped in the fifth right heading, their only means of escape blocked by afterdamp, the gaseous products of the explosion containing the deadly carbon monoxide. Two of the men who tried to make their way through were overcome by the gas and died. The others waited for help and, when equipped with self-rescuers, the chemical filling of which is a product of chemical-warfare research, made their way through the firedamp unharmed.

The self-rescuer is a commercial pocket-size respirator consisting of a canister which is fitted with a mouthpiece, nose clip and exhalation valve. The chemical filling of the canister, which eliminates carbon monoxide from the air breathed, is a mixture of metallic oxides, known as "hopcalite." Hopcalite is employed not only in the miners' self-rescuer, but also in gas masks for firemen and other workmen who may encounter dangerous concentrations of carbon monoxide. It is also used in carbon-monoxide recorders and alarm devices, such as in the recently



In Developing Commercial Uses for New Chemical Mixtures, the Army Gas School Uses This Tank Apparatus to Test the Effects of the Gases on the Human Constitution

constructed underwater Holland tunnel between New York and New Jersey.

Prior to the discovery of hopcalite, there was no type of gas mask which would provide protection against carbon monoxide, other than the oxygen inhalator, a cumbersome type of equipment which is a self-contained mask with its own supply of oxygen. It was discovered, ultimately, that a specially prepared granular mixture of the oxides of copper and manganese will change carbon monoxide when mixed with oxygen of the air, to carbon dioxide, a relatively harmless gas. This mixture of metallic oxides is called "hopcalite" in honor of the two universities, Johns Hopkins and California, where the basic principles were evolved.

Composite Drawing of Proposed Traffic Plan in Paris, Where Double-Decked Streets and Cross-Overs Are under Consideration

AUTO VALVE-SPRING TESTER HELPS SAVE GASOLINE

Balanced springs insure better performance of the automobile motor with consequent saving in gasoline, faster pick-up and other advantages. To detect weak and faulty springs, a simple tester has been introduced. It is arranged so that the springs can be tried while in the block or when removed, and operates accurately. The entire test can be made in a few moments. The state of the springs is determined by a gauge.

¶It takes about two years for a baby whale to grow to an adult.

TWO-LEVEL STREETS PLANNED TO SPEED PARIS TRAFFIC

One of the plans under consideration for relieving the traffic situation in Paris involves the building of two-level streets. An elevated pavement would be provided for pedestrians only, and the stores would have entrances and show windows on this level. Bridges would be constructed at street crossings. The level for vehicles would have space for parking cars and stairways would be provided at convenient locations. A feature of the plan is the concealed tubular lamps which would eliminate need of electric-light standards.

TWO MILLION PENNIES A WEEK USED BY BIG STORE

Pennies at the rate of seven tons a week were used by a large New York department store during the holiday season. One reason for the huge demand was the fact that most of the merchandise was priced at odd figures, and as the store's business is done on a cash basis only, pennies were needed for practically every transaction to make the proper change.

Demonstrating the Table Basketball Game; the Ball Is Sent into Baskets by Striking Projecting Sticks

BASKETBALL PLAYED ON TABLE LATEST PARLOR GAME

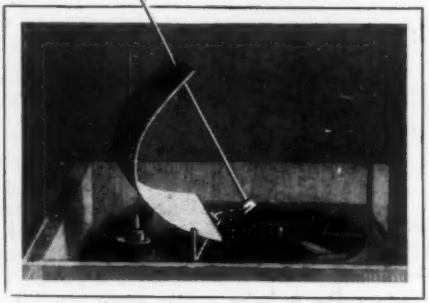
Table basketball, a game devised by a student at the Kansas agricultural college, has appeared in the form of a simple outfit that will amuse the players as well as spectators, and also test the skill. It consists of a metal box, the top of which is a cardboard field, depressed in the center to permit the ball to roll into any one of a number of holes along this part of the field. At either end is a small woven basket on an upright. By striking down on the end of small sticks or levers that extend under the field to the holes and project a short distance at the sides, the ball is thrown up out of the hole and, if properly propelled, falls into a basket, scoring two points for the player. The sticks on one side reach only certain holes and those on the other reach the rest, so that opposing players can "shoot." If the ball is struck off the field, a foul is counted and the other player enjoys a "free throw," a chance to shoot for a basket just as in the real game.

INSECTS AS LEPROSY CARRIERS STUDIED BY DOCTORS

Studies are being conducted by the army research board at Manila to discover if insects may not be carriers of leprosy. The investigation was started several months ago and, although but one case of transmission of the disease by a mosquito has been definitely recorded, the experiments are still under way. The insects are allowed to visit leprosy patients and then to bite volunteer subjects, men who, with the permission of the late governor-general, have been selected from among prisoners serving long terms. After more than sixteen months, none of the volunteers has been affected, but this is not long enough for final decision in the matter, and it is pointed out that none of the subjects may be susceptible to the disease. The cause of the spread of the malady is still a mystery. Married couples, one of whom has leprosy, have lived together for years without the other one acquiring the disease. Climate and density of population have been thought to have some connection, but they alone cannot be the reason for the spread of leprosy, studies have shown. Insects do not always acquire the germs after feeding on leprosy patients and, in the rare instances when they do, they do not always immediately bite a well person, but doctors still believe that mosquitoes, flies, fleas and other insects may be at least partly to blame.

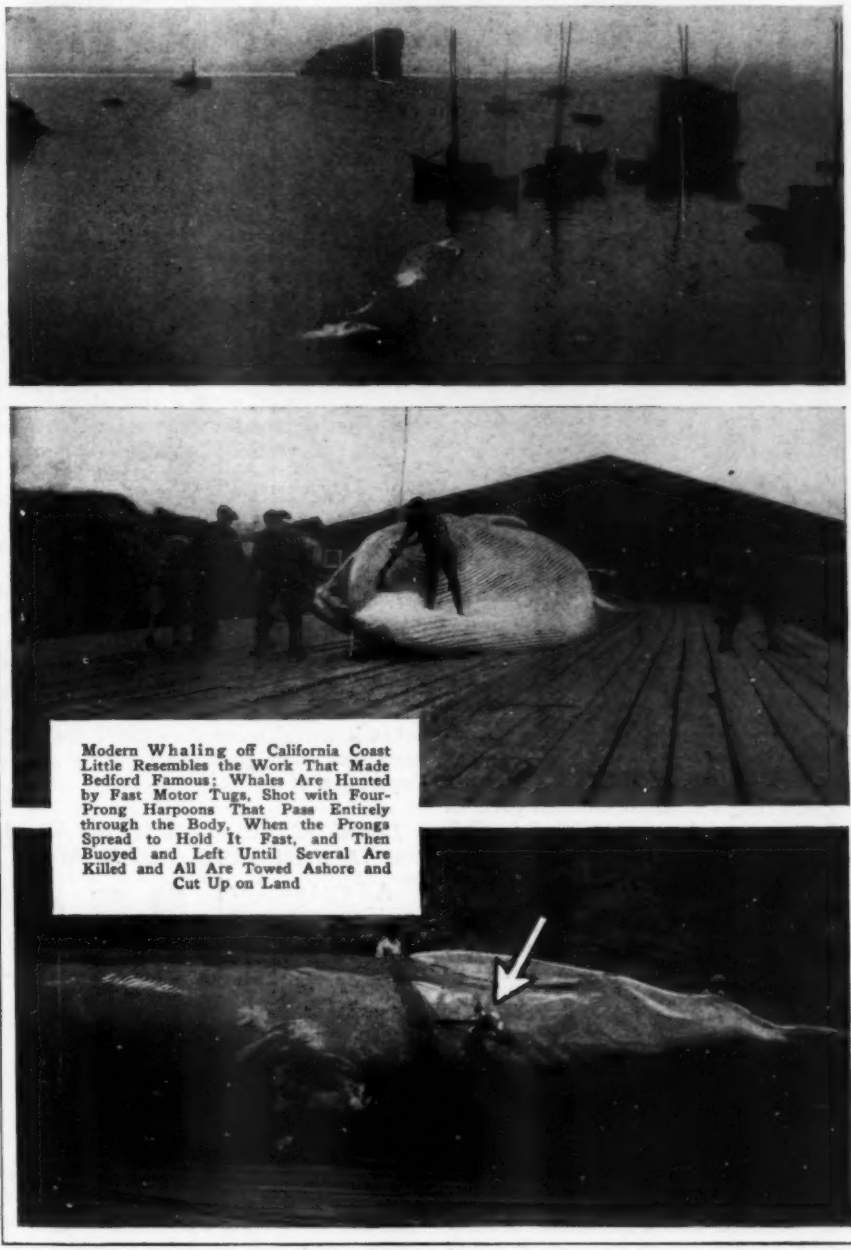
CARDBOARD MAKES SOUND BOX FOR PHONOGRAPH

As a substitute for the usual sound box on phonographs, a Swedish inventor has devised a way to make ordinary cardboard amplify the tones reproduced by the needle. The cardboard is simply bent and mounted as indicated in the accompanying illustration and attached to the needle by a special mechanism. The invention has been patented.



Bent Cardboard, Which Is Said to Give Results as Good as Those of the Usual Phonograph Tonearm

WHALING HAS CHANGED SINCE MOBY DICK'S DAY



Modern Whaling off California Coast Little Resembles the Work That Made Bedford Famous; Whales Are Hunted by Fast Motor Tugs, Shot with Four-Prong Harpoons That Pass Entirely through the Body, When the Prongs Spread to Hold It Fast, and Then Buoyed and Left Until Several Are Killed and All Are Towed Ashore and Cut Up on Land

The Fire at Its Height, Burning in the Upper Stories of Uncompleted Chicago Skyscraper on a Winter Night

FIRE HUNDREDS OF FEET IN AIR TESTS FIGHTERS' SKILL

Scaffolding, and other wooden parts in a skyscraper under construction in Chicago, caught fire forty stories above the street when the temperature was nine degrees below zero, giving firemen a busy hour before the flames were extinguished. Hose had to be hauled up by hand, while ice and wind added to the difficulties.

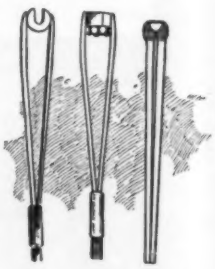
RED INK STAINS ON MARBLE REMOVED WITH LIME

When vandals disfigured the Ypsilanti monument at Ypsilanti, Mich., with red ink, city officials were perplexed as to how to remove the stains. A paste was prepared, chiefly of chlorinated lime, and spread over the statue. After it was dry, it was removed with a trowel and a fresh coating applied. Each succeeding application removed some of the stain until it had been nearly obliterated. A shed was built over the monument during the process to permit warming the chemicals.

FUEL OIL REPLACES GASOLINE IN BUSSES

Successful use of a heavy fuel oil instead of gasoline to run motor busses is reported by an eastern company. This has been made possible by equipping the engine with a special unit, the invention of a New Zealander, consisting of an aluminum pot in which is a nest of thin, curving plates, radiating from a central core. This device is said to help convert the oil into a dry gas before it is passed into the intake manifold. Substitution of fuel oil for gasoline is being watched by engineers who point out that it would mean an annual saving of not less than $50,000,000 simply in the operation of motor busses.

LONG PLIERS FOR MANY USES AID IN SHOP AND HOME



Adapted for picking up almost anything from a thread in weight to ten pounds, specially constructed pliers have many uses around automobiles, in the shop or home. The tools weigh but two ounces and are thirteen or seventeen inches long. Putting in valve locks, removing corks from bottles and fastening or removing nuts, etc., are a few typical uses.

The Wonder Metal

A Long Bar of Beryllium and a Short One of Steel, Both of the Same Weight, and Chart Showing the Position of the Metal in the Electronic Scheme

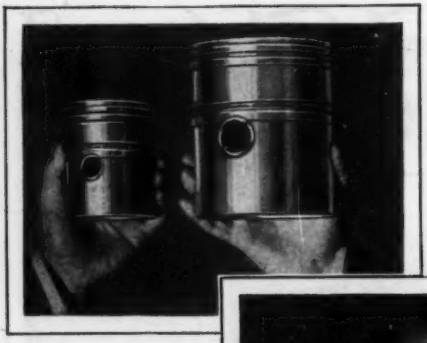
A WONDERFUL new metal, one-third lighter than aluminum and with most of the valuable properties of steel, will soon be placed on the market. Assuming that its cost is not prohibitive, its use will greatly reduce the weight of airplane engines, and providing its price eventually becomes low enough, it may also be largely employed in automobiles with vast reduction in weight.

The name of this new metal is beryllium, a chemical element like iron, copper, aluminum and lead. While it is too early to state positively just how extensively the material will be utilized, a preliminary investigation suggests that, when it is suitably alloyed with other metals, it may be employed almost any place where iron, steel and aluminum are now used. If this view proves correct, airplane engines of the future may be built almost entirely of beryllium, weighing perhaps half as much as similar engines today which are mainly constructed of steel, cast iron and aluminum.

Strictly speaking, beryllium is not new. That is, it has been known for more than a century, but during all these years scientists have been unable to develop a suitable process for the extraction of the metal from its ores. Recently, however, a Cleveland scientist and metallurgist, Hugh S. Cooper, and his associates have developed a patented process which permits production of the metal on a commercial scale, and definite steps are now under way for its manufacture.

The existence of beryllium was first indicated in 1797 by Vauquelin, a French investigator. Early scientists tried to reduce the ore to secure the pure metal, but it was not until 1828 that Wohler, the celebrated German chemist, succeeded in producing a laboratory sample. Since that date, various experts all over the world have tried to develop a commercial process but, in spite of their efforts, beryllium remained a laboratory curiosity until Cooper worked out his method.

Many people have the idea that beryllium is a rare metal, but this is far from

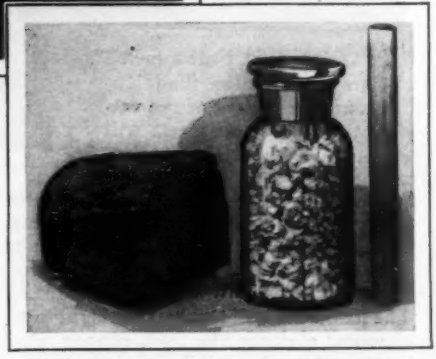


true. In the United States alone, the ore occurs in more than fifteen states and is especially available in Colorado, South Dakota, Connecticut and New Hampshire. In the last state, there is a whole mountain of beryl, a hard, stony substance composed of the oxides of beryllium, aluminum and silicon. In short, there is plenty of beryllium ore all over the world, and the rareness of the metal heretofore has been due entirely to the difficulty in separating it from the other elements in the ore.

It is still too early to say just what the eventual price of beryllium will be, but experience with the development of other metals suggests that the price will be fairly high at first, gradually being reduced as the scale of production increases and still further improvements in methods of manufacture are worked out. In so far as cost is concerned, the future history of beryllium is likely to parallel the past history of aluminum.

Aluminum ore was discovered in 1700 but separation of the metal from its components was so difficult that it was not until 1828 that Wohler produced a few particles in his laboratory. Others improved the process so that a few years later aluminum could be bought for $115 a pound. In 1854, Deville devised a new method which brought the figure down to $7.00 a pound and refinements on this method later cut the price to about twenty-five cents a pound. The future history of beryllium, it is to be hoped, will show a similar price trend.

Pure beryllium is a dark gray metal which takes a high polish like steel. In fact, a polished specimen might be mistaken for steel until it is picked up, and then it is realized that this stuff that looks like steel is much lighter than aluminum. It is so hard that it cannot be scratched with a file, and since there is a close relationship between hardness and strength, the pure metal compares with steel rather than aluminum in this respect. Beryllium is about five times as hard as aluminum.



A Small Cast-Iron and Much Larger Beryllium Piston, Both Having the Same Weight; H. S. Cooper, Who Developed the Commercial Extraction Process, and the Three Steps, Beryl, the Rock, Beryllium Oxide, in the Bottle, and the Metal

While pure beryllium is very hard, it is also brittle, and for most purposes its brittleness must be reduced by alloying it with various other metals, such as aluminum, copper and iron. Beryllium and aluminum may be alloyed in all proportions, and this is quite fortunate, because one of the chief difficulties in securing pure beryllium lies in the elimination of the aluminum also found in the ore. Hence it is cheaper to make a beryllium-

aluminum alloy than it is to produce the pure metal.

Beryllium, of course, is so new that most of the possible alloys of this material with other metals have not yet been made and tested, but what has already been done suggests that in a reasonable time an amazing beryllium alloy will be discovered.

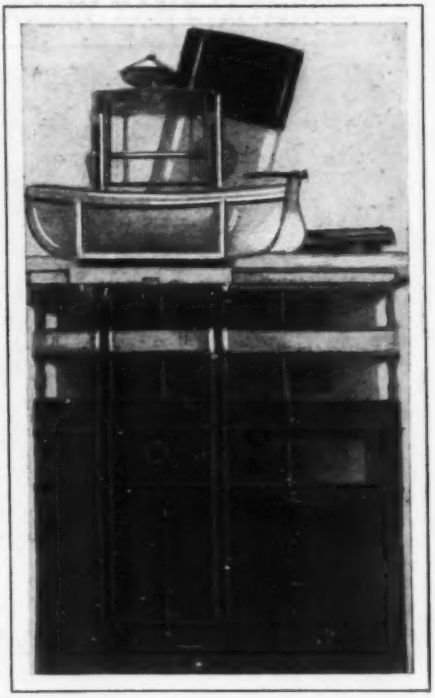
DISTANT SWITCH STARTS AUTO SAVING DRIVER TIME

For speedier response to fire alarms, an officer of an English fire brigade has devised a remote-control starter for the motors of the apparatus. Throwing a switch in the office, or other convenient location, starts the engines of the cars so that they are ready to go the instant the driver reaches his seat. The device can be applied to private uses. Physicians, for instance, could install a switch in their bedrooms and start the auto engine running at the distant garage so that time would be gained in answering a call.

HOLDER FOR BABY'S BOTTLE FITS ON HIGH CHAIR

Attachable to a high chair or baby carriage, a holder for the nursing bottle is made of spring wire, covered with white rubber. It prevents the infant from spilling the milk or breaking the bottle.

Bottle Holder on Baby's Chair Prevents Breakage and Spilling; It Is Covered with Soft Rubber



Model of Proposed Lifeboat-Lowering Rig, a Track down Side of the Vessel Instead of the Usual Davits

LOWER LIFEBOAT ON TRACK TO PROMOTE SAFETY

A means for the safer and more rapid lowering of lifeboats has been developed by Capt. A. T. Nelson, of Milwaukee, Wis. Instead of the usual system of davits, he has introduced a track which follows the side of the vessel and permits the boat to be lowered to the water on two rails. They hold the small craft from swaying or tipping and are not likely to be obstructed by ice.

THREE-STORY HOUSE OF GLASS

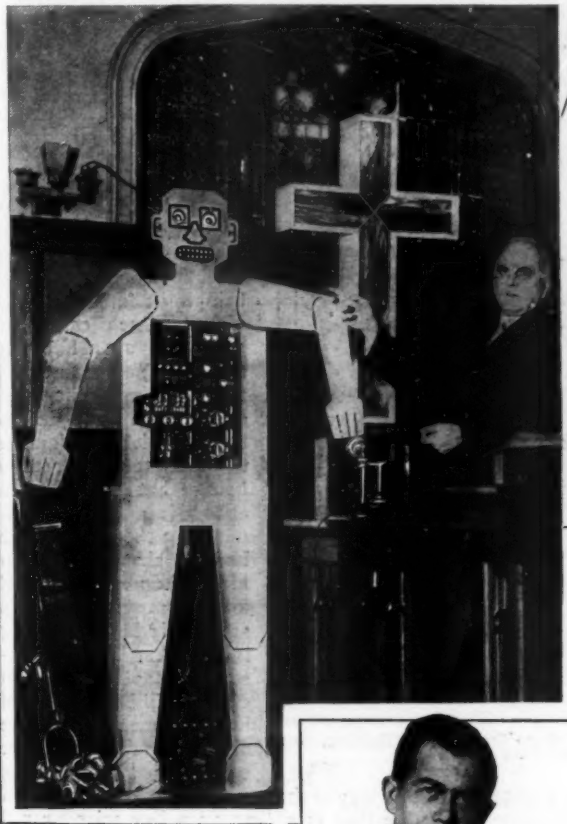
Plans have been completed for the construction of a three-story glass house on top of a New York building. It will be made of glass "bricks," translucent but not transparent. They will be connected by concrete and steel reinforcing. Interesting effects in lighting will be produced at night, when the house is illuminated from within, the architect promises.

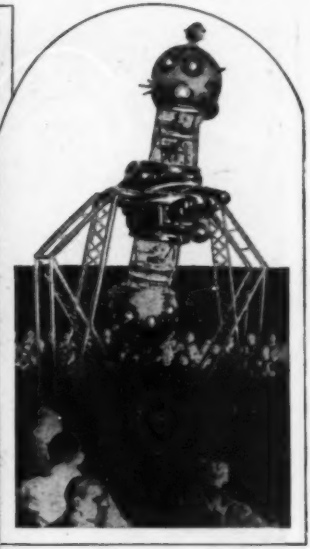
"ROBOTS" THAT WALK AND TALK, SIT AND STAND,

Below Is Capt. A. J. Roberts' Mechanical Man, an English Invention, in the Act of Sitting Down Following a Verbal Order

A Stage Demonstration of What a Brainless Brain Child of Professor Popjie Can Do; "Radiana," the Wireless Barber, Is Shaving a Customer, While the Human Guardian Stands by to Make Sure the Razor Doesn't Slip; at the Top Is a Mechanical Traffic Policeman Used in Berkeley, Calif., to Supplement More Conventional Traffic Signals; the Tiny Policeman Turns to Face the Direction in Which Traffic Is to Be Stopped, While Bells Sound a Warning; the Pedestal Is Also Equipped with a Fire Siren to Stop All Traffic in Case of Emergency; by Combining Wireless, Speaking Apparatus, and the Necessary Motors and Gears, It Is Possible for a Clever Inventor to Reproduce Any Form of Motion

DO EVERYTHING, IN FACT, BUT THINK FOR SELVES





The Weird "Monster" Above Is a Planetarium, Capable of Throwing on a Domed Ceiling the Planets and Stars as They Are, Were or Will Be at Any Date

Built Originally as a Collection of Electrical and Mechanical Parts to Control Machinery from a Distance, Roy J. Wensley's Robot Has Been Dressed Up in Human Form and Goes to Church, as Guest of the Rev. Christian Reisner; the Mechanical Man Can Answer the Telephone and Carry Out Any One of a Series of Orders; in Ordinary Life, One of His "Relatives" Reports on the Condition of the Water Reservoirs at Washington, Eliminating Human Watchmen; at the Right Is Dr. Benjamin Gaylord Hauser with His Chemical Man, Which Imbibes and Digests Food Just Like the Living System, and Thereby Demonstrates in Graphic Form What Happens When We Eat; the Round Bulb at the Top Represents the Mouth, and the One in the Center the Stomach

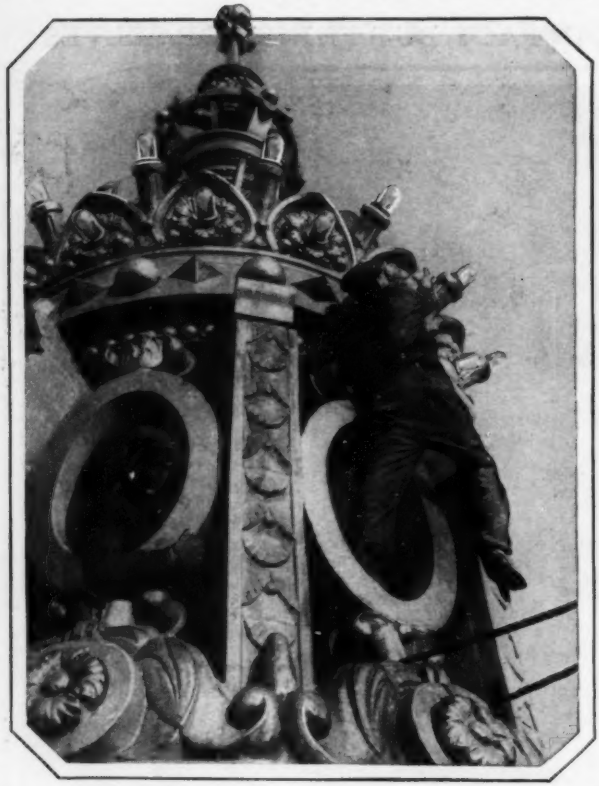


Photo by Ewing Galloway

Replacing Electric-Light Bulbs on Top of the Grand Central Building, New York City; Note the Outer Shields

SHIELDS FOR TOWER LAMPS HELP PREVENT BREAKAGE

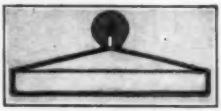
Electric-light bulbs on top of the thirty-six story Grand Central building in New York city are protected with outer glass shields to guard them against damage by winds and driving snow, rain and hail. Bulbs installed in such places, where they are exposed to the full force of the elements, break more frequently than in more protected spots, and special means are devised to reduce replacements to a minimum. Fitting new bulbs is not always an easy task, although, in the case of the Grand Central building, the workers have little difficulty and run small risk of accidentally falling, because the protruding ornaments on the tower offer abundant hand and footholds.

SMALL BIRD PUTS OUT LIGHTS BY SHORT CIRCUIT

Electric lights in an English town were suddenly extinguished the other night. The cause was a short circuit on the line resulting when a small bird evidently attempted to fly between the wire and the arms of the insulator. Its feathers established a contact, bringing about the short circuit. Such cases are rare, for small birds alight on power lines, on third rails and other conductors without injury to themselves or damage to the system, the reason being that they seldom establish a "ground" whereby the current can be short-circuited. Larger birds often come to grief and sometimes when small birds are flying in flocks, the necessary contact for a short circuit will be established between members of the flock. Small birds are often killed in pairs in this way if the tail or a projecting wing of one that is sitting on a live wire or rail comes in contact with the body of another bird through which a ground is formed.

FLOAT PREVENTS SKIN ON MILK WHILE BOILING

To keep skin from forming on the surface of milk while being boiled, a hollow metal float with a knob has been introduced. It is placed on top of the milk before boiling and removed after the liquid has cooled to about 122 degrees Fahrenheit. The float is made in a range of sizes to fit various pans, and is said to operate effectively.



"JOY RIDER" FOR AUTOS IS THE LATEST AMUSEMENT

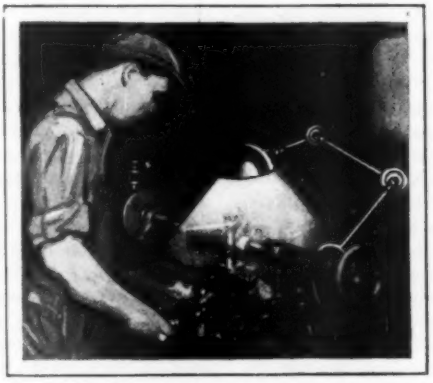
Wayside Thrills for the Motorist; a "Scenic Railway" Idea Adapted for the Automobile in a Drive over Hillocks Made from Piles of Earth; an Admission Charge Repays the Owner

Motorists are enabled to experience some of the thrills of an amusement park without leaving their cars, on a "joy rider" road built near a Texas highway. For an admission charge of ten cents, autoists drive into a large field where a road that passes ocean-wave fashion over a series of small hills scooped up out of dirt, gives sensations like those of a roller coaster.

ENGLAND BUILDS SECRET PLANE TO SEEK DISTANCE RECORD

A mystery airplane, secretly built in England, was tested recently preparatory to an attempt to break both duration and distance records. The machine, a Fairy-Napier monoplane of 100-foot wing spread, adds Great Britain to the countries turning to the monoplane. Heretofore, practically all British ships, both large and small, have been biplanes. The 450-horsepower Napier engine is reported to have a special carburation system designed to produce maximum horsepower with a considerably lower gasoline consumption than usual. The ship also is said to be equipped with a type of direction indicator which sounds a horn beside the pilot's ear if he deviates from the prescribed course. How the system works is a secret, but it is said to be the result of several years' research work. The ship carries 1,000 gallons of gasoline which is kept in wing tanks. The pilot's seat is fitted with pneumatic cushions to relieve the strain of long hours, and a couch in the cabin is similarly equipped to provide a resting place for the relief pilot. There also is a comfortable chair and a folding table for the navigator. It is planned to try first to break the duration record for unrefueled planes, now standing at 65 hours 25 minutes, and then attempt an 8,000-mile flight from London to Capetown, with only one stop for fuel.

LIGHT CAST FROM ANY ANGLE BY JOINTED FIXTURE



One of the Many Uses for the Special Light Stand That Has Six Joints

Having six joints of special construction, an electric-light fixture now on the market can be adjusted easily to throw the rays where they are most needed. The fixture may be turned in a complete circle, swung high or low, tipped or turned in any direction, saving time and trouble in readjusting the entire standard.

14,000

Eddie Stinson and His Wife Snapped at Mills Field, San Francisco, on Last Summer's National Air Tour

By J. EARLE MILLER

EDDIE Stinson, barnstormer, war pilot and airplane manufacturer, the other day finished his fourteen thousandth hour in the air, a record, it is claimed, no one else anywhere in the world has ever approached.

Fourteen thousand hours represent 583⅓ days of twenty-four hours each, or the equivalent of about nineteen and a half months in the air, if they were all strung together in one flight.

For a man still in his early thirties to have spent nearly two years in the air is a remarkable thing, but more remarkable still is the fact that after fifteen years of flying, it still holds its lure—the one thing he wants to do. The great majority of flyers, after a few years' experience, retire into something not quite so hazardous, but Eddie Stinson expects to keep on flying as long as he lives. The answer is that he is one of those rare persons, a natural-born flyer.

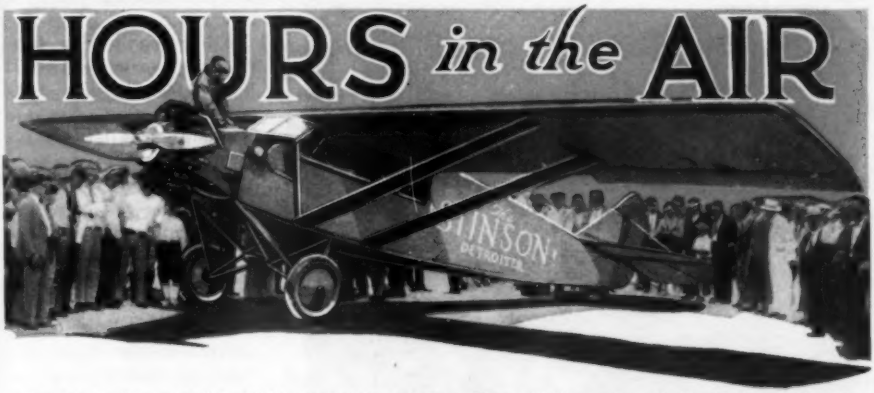
That is not to be wondered at, for he comes from the greatest flying family in the United States, and, so far as American and British records show, the world. The flying Stinsons have produced four pilots—Katherine, Marjorie, Eddie and Jack—a record believed to be unique.

How does it feel to have spent 14,000 hours in the air?

"I've never given it a thought," Eddie confessed the other day. "It's the one thing I want to do, and the only thing I know how to do—build planes and fly them. I get in six or eight hours every Sunday, usually flying down to Chicago from the factory at Northville, Mich., to spend the day with the boys at the airport, and, while we have a test pilot, I usually manage to get in a bit of time on every plane we build."

What those bits of time amount to is indicated by the fact that, in the two and a half years since he became an airplane manufacturer at the head of his own factory and began turning out commercial ships and special jobs for transatlantic and round-the-world flyers, he has managed to keep up his average of around a thousand hours a year in the air. Last year, with Capt. George Haldeman, he took a Stinson "Detroiter"—a six-passenger monoplane fitted with special gas tanks instead of passenger seats—down to Jacksonville, Fla., and set up a new world's endurance record of 53 hours 36 minutes and 30 seconds, the second time in a few years that he held the endurance mark.

HOURS *in the* AIR



The Stinson "Detroiter," in Which the Builder and Capt. George Haldeman Last Spring Broke the World's Endurance Record; a New Ship Is Being Built to Regain the Mark, Now Held Abroad

Both the Italians and the Germans have since bettered that record, but a new Stinson is coming out of the factory shortly to go after it again, and Eddie will be at the controls half the time.

His chief recollection of the two and a fraction days of monotonous flying over the Florida coast last spring is that it allowed him to catch up in his lost sleep.

"We carried an eiderdown quilt and a supply of magazines for entertainment," he explains. "The one off duty would stretch out, read a bit and then go to sleep. I got almost twelve hours sleep out of each twenty-four. About the only discomfort was watching George's beard grow and wishing we would get it over with so he could shave."

Haldeman was no novice at long flights in a "Detroiter," for he piloted Ruth Elder almost to the Azores on her ocean flight.

The flying Stinsons' connection with aviation is almost as lengthy as that of the Wright brothers. Along about 1903 and 1904, when the Dayton bicycle men were making their first flights with power, a boy in knee pants, down in Mississippi, with the assistance of two sisters, was building glider-type kites. The trio were Eddie, Katy and Marge, who grew up to be, respectively, an airplane builder and a pair of famous women dare-devils.

By the year 1909, when the Wrights were winning their first world-wide recognition, the Stinson children were getting 200 and 300-foot flights in gliders big enough to carry them and attaining the respectable altitude of ten to fifteen feet. It must be remembered that the Wrights did most of their power-airplane flying at that time around fifty feet above the ground and publicly announced they saw no reason for going higher.

Katherine went to Chicago in 1912 and learned to fly a Wright Model-B, a curious contraption that a spectator described as a rather flimsy front porch with a pilot sitting out on the steps. At the same time Eddie, who had reached the respectable age of seventeen, was building his own machine, with the help of a couple of garage mechanics, in St. Louis. There wasn't any suitable engine on the market, so they built that, too.

The finished product bore a close resemblance to the Wright, even to the pair of chain-driven pusher propellers in the rear. With it he did a lot of ground flying and learned to handle a plane perfectly up to the moment it reached flying speed and took to the air. Every time it got off the ground, however, the trip wound up in an accident, and the machine had to go into the shop for repairs. Finally it had been crashed and repaired so many times the builders ran out of places to put fresh patches and Eddie decided to go down to Dayton and enter the Wright school, an arrangement which had the advantage that the cost of tuition included all repairs, if the student cracked up the school ship, the singular being correct as, most of the time, the school had only one plane.

Stinson in the Plane, and the Mayor of Jacksonville Wishing Haldeman Good Luck before the Start of the Flight

Katherine already had become a famous state and county-fair attraction, and Marjorie went through the Wright school that same summer of 1914 and followed in her sister's footsteps, while Eddie went barnstorming, too.

The family had moved to San Antonio, and put that ancient Texas town on the flying map long before the army made it the greatest flying center in the country by establishing there Brooks and Kelly, the chief primary and finishing flying schools during the war and since.

Eddie says the funniest experience in all his 14,000 hours happened at San Antonio while he was still in his teens. He was flying a Wright model, homemade, and, by permission of the commandant, was using the parade ground at Fort Sam Houston as a flying field. One day the commanding officer served notice he would have to move away, as the army was sending down four ships to establish the nucleus of an air corps at Ft. Sam Houston, and it wouldn't be safe for a kid in a forty-mile-an-hour Wright to be fooling around in the air when four fast "Jennies," ships capable of as much as eighty miles an hour, were in the same vicinity.

So the young flyer went out and located his first field, a level track south of town, borrowed a pair of sheets from his mother, staked them down to mark the spot, and returned to the fort to start his first cross-country flight, a journey of seven miles.

All went well the first half of the distance, and then, as he shoved the control stick forward to nose down and lose some altitude, nothing happened. He kept on

The New Fairchild "21," a Low-Wing Monoplane Designed as a Training Ship for Student Instruction, Is Typical of the Drift Away from the Biplanes of Recent Years

shoving until he had the stick all the way down to the crossbar on which his feet rested, with the result that finally, perhaps because of the displacement of his weight, the homemade plane went into a dive.

Back came the stick until it was pressed tight against his chest, and again nothing happened. He squirmed sidewise out of the seat and kept on pushing until the stick was where he had been sitting, and then the plane nosed up. At the same time he located the source of the trouble. A bolt which acted as a pivot for the elevator controls had sheared off, and instead of going up and down when the controls were moved, the elevators were simply sliding back and forth. The breaking of the same bolt made it impossible to warp the wings, a necessary function which took the place of ailerons in the Wright ships.

Typical Two-Passenger Coupe of the Air, and, Above, the Retractable Landing Gear of the Fokker Amphibian Pulling Up into the Stub Pontoon Wing

By alternately shoving the stick all the way down and pulling it all the way back, he succeeded in descending in a series of short dives, all the time hoping to reach his new field, until finally his ship was not more than thirty feet from the ground.

Afraid to try another dive, he shut off the ignition and let the plane settle to the ground, making a landing in a corner of a cemetery without breaking anything. The sexton ran over to investigate, and Eddie explained he couldn't get out of the cemetery until he got a three-sixteenth-inch stove bolt to repair the controls. The sexton thought one might be found, and together they rummaged through all the junk in his storeroom, without success. Finally the sexton inquired if the boy flyer was superstitious, and volunteered the information that one of the vaults contained an ancient iron-plate coffin, fairly studded with bolts.

Together they rolled back the stone

cover, inspected the coffin and found a bolt just the right size. Repairs were made, young Stinson took off and landed safely beside his mother's sheets at the new field.

It was on the same field that Marjorie won the title of the "Flying School Ma'rm," when she opened an aviation school and became the first woman pilot to give flying lessons. She and Eddie together trained a large number of flyers for Canada before the United States went into the war, while their mother helped manage the business.

One of the queerest of flying incidents happened during that period.

"We had a student," Eddie says, "who didn't want to fly, and was afraid to fly. He was of army age, and if he had to go into the army, he had decided he wanted to be an officer, so joined up to get a flying commission. In private life, he had been a ribbon clerk, and if anyone ever looked and acted as you would expect a ribbon clerk to look and act, he did.

"We labored and labored over him, and finally one morning he made three fairly decent landings in succession, so I told him to go ahead and solo. To get his ticket, he had to take off, go up and do two figure eights, and come down and make a good landing within a certain distance from a mark.

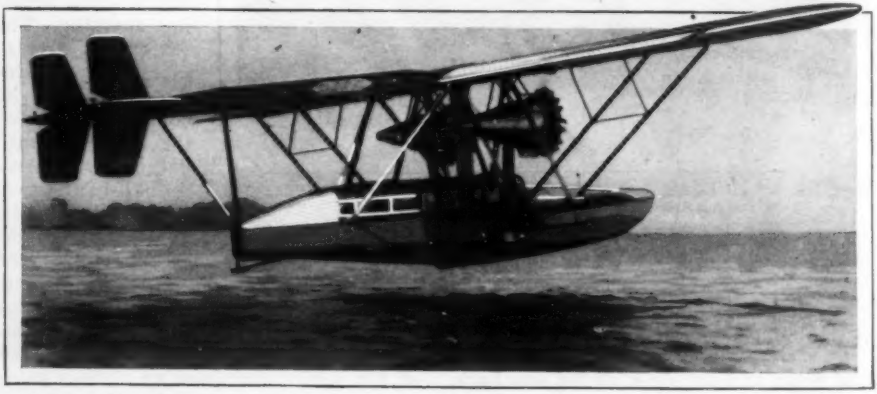
"He made a perfect take-off, climbed to the right altitude, did a pair of as nice figure eights as anybody ever saw, circled out downwind, turned and came into the field at just the right altitude, at the correct moment he cut the gun and nosed down in a gentle glide, leveled out just when he should, pulled the nose up as the plane lost speed, and was settling for a perfect three-point landing, with the plane hardly six inches off the ground, when he lost his head and jumped overboard.

"The ship landed and rolled along to a stop, while the student was nearly killed from the head-first impact at thirty miles an hour."

With the entrance of America into the war, Stinson was commissioned, and immediately assigned as an instructor to Kelly field. There he stayed, for there were plenty of students to send to France, but good instructors were rare. As "final check" pilot at Kelly, no student could graduate until he had a certain number of minutes in the air with Stinson and received his O. K.

At Kelly, Stinson became famous for two things: his stunts with a ship of his own design, and his ability to break light globes with a wing tip, the last of which proved a remunerative occupation, as there was always a certain number of people willing to bet it couldn't be done.

Every structure around a flying field is marked with a red warning light, one of the most prominent being the light atop the flagpole. Eddie's usual bet was $100 that he could fly over the flagpole and gauge the distance so accurately that he could crack the glass globe off by brushing it with a wing tip, without damaging



The Twin-Motored Sikorsky Amphibian, a Luxurious Aerial Yacht; When Its Wheels Are Lowered, It Can Land on Any Fair-Sized Field, or Draw Them Up and Alight on Water

Looking Forward in the Cabin of the Sikorsky Amphibian; the Two Pilots Are in a Separate Compartment, and the Kitchenette and Lavatory Are at the Rear of the Ship

his ship. As a collision with the flagpole at a flying speed of eighty miles an hour or more would be fatal to both ship and pole, there were frequent takers of the bet, but they invariably lost.

His little homemade monoplane handled so perfectly that one of Stinson's favorite stunts was to climb the side of the field water tank, drop across the top and go down the other side until the ship picked up flying speed. To do the trick he flew straight at the water tank, with his wheels just off the ground, pulled the stick back just before a crash seemed unavoidable, zoomed the ship up the side of the tank until it lost flying speed just above the top, shoved the stick down and flipped over the top, then down the opposite side until he got speed when he would pull the ship up and level out again.

What his 14,000 hours of flying represents can be visualized by reducing it to mileage. Forty to forty-five miles was top speed in the early days, but 150 and better is common now, so it is safe to say he has averaged better than 100 miles an hour over the 14,000 hours. At that rate, his 1,400,000 miles represents three round trips to the moon and back, which is a respectable lot of miles.

BLOOD MADE WITH CHEMICALS TO HELP GAS VICTIMS

One of the iron substances found in the blood has been prepared synthetically by a German chemist, according to reports. It is expected that the discovery will be useful in cases of gas poisoning, although at present blood transfusion is cheaper.

Tennis Gun That Hurls Balls across Net for Benefit of Player Practicing Strokes

TENNIS GUN HELPS PLAYERS PRACTICE HARD STROKES

Tennis players can practice without an opponent by means of a gun that hurls balls at them from across the net. This unit gives them an opportunity to develop a number of strokes and enables the instructor to check their work, as he can watch each play.

HOME MOVIE AND RADIO PLAY ARE LINKED TOGETHER

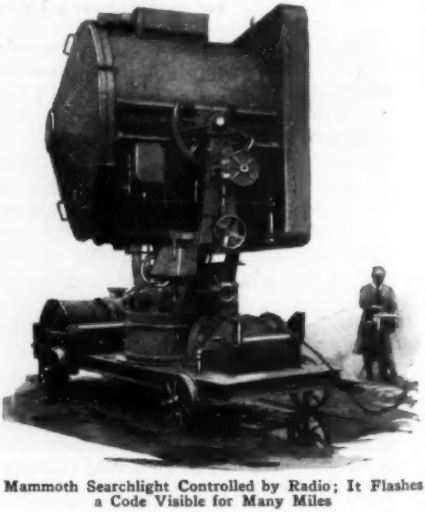
A synchronizing device for attachment to the radio receiver, so that a home movie projector can be operated in conjunction with plays broadcast over the ether, is being tried out in England. The British broadcasting corporation, which operates "2Lo" and other government-controlled stations, recently filmed a movie to try out the device, invented by Mr. G. V. Dowding. The synchronizer is claimed to be so accurate that it will not get more than one second out of step in twelve months. It is planned to lease the movie reels at a nominal sum. When a movie-radio play is to be announced, the broadcasting station gives the reel number, allows time to insert it in the projector, and the announcer then directs the audience to press the button that starts synchronizer and movie projector. The first movie-radio play filmed involved a chase of an escaping convict.

STUTTERING CHILD AS BRIGHT AS NORMAL PUPIL

Stuttering may be a handicap, but it does not necessarily indicate lack of mental ability, tests performed on 7,138 school children by Dr. Elizabeth D. McDowell, at Columbia University, disclose. It was found that the stuttering pupil has as high intellectual capacities as the normal child, that his vocabulary is as good and that, usually, he is physically superior. Other tests proved that the stutterer could speak as many words in a three-minute period as any other pupil.

BIG SEARCHLIGHT SENDS CODE BY RADIO CONTROL

Beams of light flash messages in code from a 3,500,000,000-candlepower searchlight recently constructed for the French government. This is done by remote radio control, a wireless apparatus, miles away from the lamp, operating a shutter so that the code is "winked" out in flashes of light. The lamp is moved by electricity, through a portable controller, being adjusted so that it can be elevated to an angle of ninety degrees for operations against aircraft. By both quick and slow movements, the beam can locate a fast-moving object and, once having spotted it, can be guided to follow it.

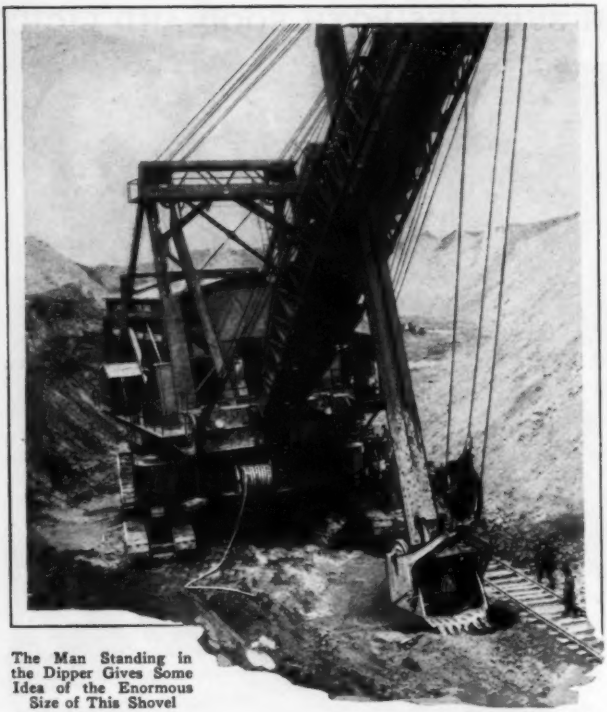


Mammoth Searchlight Controlled by Radio; It Flashes a Code Visible for Many Miles

"HOOLIGAN" FISH SUPPLIES BOTH FOOD AND LIGHT

Indians at "Hooligan" Fishing Time; These Fat Little Fish Yield Oil That Serves as Lard or as Substitute for Ice Cream

In the Pacific coast region, nature was generous in supplying the aborigines with food resources. Many of the primitive industries still exist. They are quaint, picturesque, and are conducted along the simplest lines. One of the most romantic and colorful of these is the harvest of the eulachon, or "Hooligan" fish, by the natives of southeastern Alaska. Picture a river of purest azure, a glacial stream winding through a valley heavily timbered with spruce and fir, above the tops of which snow-capped mountains tower majestically. On the bank of the river, Indians, clad in nondescript but picturesque garb, toil or play in the hot sunshine of the short Alaska summer, the men sweeping the waters of the stream with crude dipnets and the women scurrying up the bank with baskets filled with gleaming fish. The eulachon is said to be the fattest of all fishes, and both the meat and the oil rendered from it have a peculiarly delicate, agreeable flavor. In the early days of Alaska gold discovery the eulachon was used for purposes of illumination by the miners, who called it the candlefish. It may be dried, thrust in the neck of a bottle, and burned like a candle. The Alaska Indian likes the oil of the eulachon better than other fish oils, and the flesh is sometimes eaten dried and smoked. The Canadian government purchases much of the oil for its Eskimo wards in the far Arctic. It is considered an excellent substitute for lard. One of the favorite dishes among the coast Indians is prepared from eulachon oil and is a native substitute for ice cream.



The Man Standing in the Dipper Gives Some Idea of the Enormous Size of This Shovel

Courtesy General Electric Co.

MAMMOTH SHOVEL BEING BUILT TO BREAK ALL RECORDS

Spurred by the success of several twelve-cubic-yard-capacity electric excavating shovels put in operation last year, a fifteen-yard unit is nearing completion, to be the largest in the world. Some idea of what a fifteen-cubic-yard shovel means may be gathered from the fact that the dipper will bite out eight large motor-truck loads of material at a single gulp, or enough earth to fill a trench six feet wide, sixty-eight feet long and a foot deep. The machine will have a boom 120 feet long and a dipper stick of eighty feet. A single man, with one set of hand levers and one set of pedals, will control every operation of the giant, according to the General Electric company, which is building the motor equipment. Power will come to the shovel through a trailing cable nearly three inches in diameter and about a thousand feet long, which will be wound on a reel at the rear.

PLANE RESCUES INJURED NUN IN ALASKA

Winging his way northward over Alaska, an aviator went to the rescue of an injured nun at the St. Peter Claver mission in Nulato recently. She was carried 400 miles in the plane to Fairbanks, where surgeons set her broken leg. The Rev. Father Joseph F. McElmeel, priest at the station, heard the faint whir of the airplane. He hurried to the post office, secured the aid of the signaling agent there, and in a few moments, the plane had landed and arrangements were made for taking the suffering nun to Fairbanks the next morning.

SPRING-MOTORED TOOTHBRUSH FOR POCKET

Giving the toothbrush a rotary instead of a sideways movement is recommended by dentists, and this is the natural action of a revolving brush now on the market. It has a small motor which causes the brush to spin rapidly when a tiny handle is pushed. The entire outfit can be carried in the pocket, is easily kept clean and is said to be beneficial to the teeth and to the gums.

Operating the Rotary Toothbrush; a Spring Motor Spins the Shaft and Buffer at Rapid Rate

Cotton's Rival

© Tropical Press Agency

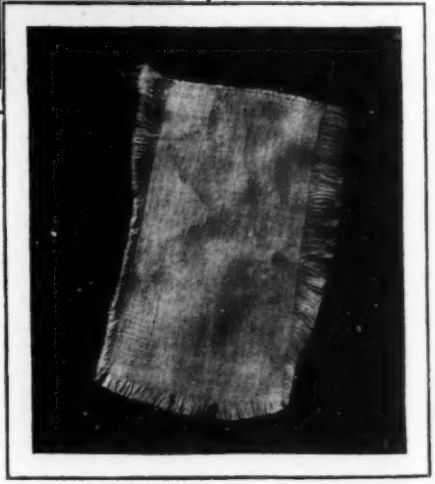
Dr. C. J. Hedley-Thornton Examining Some Samples of "Artificial" Cotton in Various Stages of Treatment; a Bird's Nest Led to the Accidental Discovery of the Plant

A SUBSTITUTE for cotton, discovered by accident in a Central American bird's nest, has quietly been put in production in England, and, with its recent announcement, it was stated that a sufficiency could be grown within another two years to fill fifteen per cent of the world's demand for cotton cloth and cotton products.

The new fiber comes from a weed, found growing wild in British Guiana. Dr. C. J. Hedley-Thornton, of London, an expert in the study of cotton pests, particularly the boll weevil, was in Guiana with a party of scientists when they discovered a bird's nest, apparently made from cotton. As no known cotton supplies were within reach of the bird, they watched, and eventually traced the nest builder to a weed from which it obtained the building material. They found nine different varieties of this weed, all very similar, but only one variety yielded the cottonlike fiber selected by the bird.

Samples of the plant were taken to England and cultivation attempted. Despite the change of climate, the weed thrived, and, by careful crossing and recrossing of selected specimens, in a few years' time began yielding plants five to seven feet high, with a far superior output of fiber. The plants grew well in even poor soil, and, so far, no insect pest has been found to attack them. Considerable areas in Sussex and Essex have been under cultivation for some time, with an average yield of 800 pounds to the acre, the acre yield being valued at $100.

Cloth made from the fiber has been distributed, without even experts detecting the fact that it did not come from a genuine cotton plant. Before going to the mills, the fiber is chemically treated, but from then on the process of converting it into usual cotton-product forms does not vary from existing methods. It is readily mixed with silk, artificial silk or wool to produce blended fabrics, and is bleached, printed and dyed in the usual manner. The cloth, it is claimed, has a higher sheen than ordinary cotton, so



The Bird's Nest That Led to the Discovery of the Plant, Top; Fiber after Treatment and Ready for the Mills, Center, and Coarse-Count Fabric Woven from the Fiber

much so that a blend of ten per cent artificial silk and ninety per cent of the new cotton makes a satisfactory silk substitute. The makers claim it takes color much more easily than ordinary cotton, and requires only about one-third as much coloring matter for dyeing.

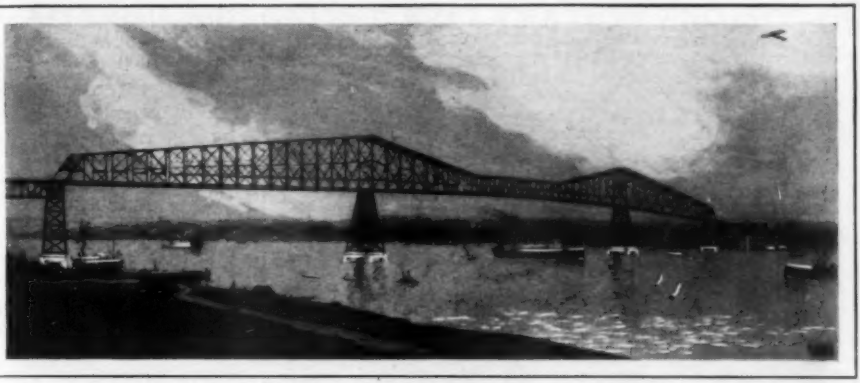
Instead of picking the fiber in the field, the plants are reaped by machinery and sent to the mills for separation. It is impossible to grow new plants from seed, as they will revert to the wild characteristics. Instead, the roots are dug, the old root having decayed and left three fresh offshoots. As a result, after each acre's crop has been dug, there are sufficient new roots to plant three acres the following year.

After the fiber is removed from the plants, the leaves can be salvaged and made into serviceable paper and the stalks into building board. Excess roots also can be utilized through the extraction of a new drug.

The progress of the development is being watched with interest in England, not only because the crop may be grown with profit on poor waste land, but because its cheapness promises to revive the cotton-spinning industry, which has suffered considerably in recent years. Neither American nor Egyptian cotton, it is claimed, can be laid down at the Lancashire mills at prices which will enable them to compete with the new product.

Chemical and structural tests of the cloth woven from the weed fiber indicate it is stronger than cotton, and also more elastic. So far, it has only been woven in the coarser grades.

Doctor Hedley-Thornton anticipates no difficulty in weaving fine cloths comparable with the best cotton fabrics, and the Lancashire mills are experimenting with the fiber preparatory to attempting to invade the entire cotton field. With the production in the hands of one company a price of 12½ cents a pound has been put on the fiber.



Drawing of the Automobile Toll Bridge That Will Connect Oregon and Washington; It Is to Cost Nearly $6,000,000 and Will Be More Than a Mile and a Half Long

LONG TOLL BRIDGE FOR AUTOS TO LINK TWO STATES

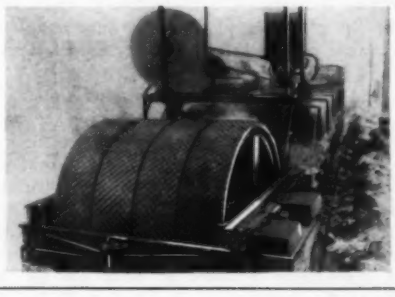
Another impressive bridge construction is under way on the Pacific coast, where a steel link is being thrown across the Columbia river to connect Longview, Wash., with Rainier, Oreg. The bridge will have a clear height of 195 feet, amply sufficient to allow tall-masted vessels to pass beneath; will be more than a mile and a half long, and will cost approximately $5,800,000. More than 13,000 tons of steel will be required. It will be operated on a toll basis. More than 600,000 vehicles will use it during the first year it is completed, engineers estimate. Work is to be finished about Feb. 1, 1930.

FOUR THOUSAND AIR ENGINES DOOMED TO BE JUNKED

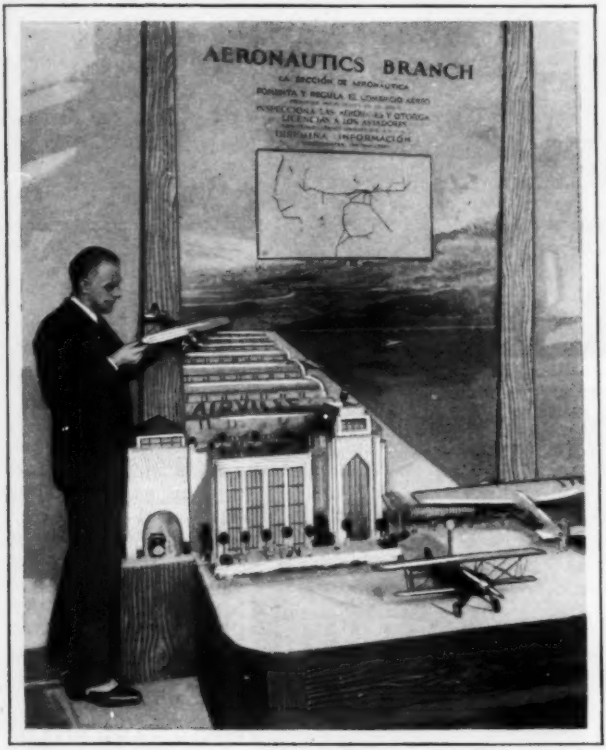
Four thousand Liberty engines, brand-new and still in the original crates, are doomed as junk, as a result of the action of the house of representatives in placing an official ban on their use in new airplanes ordered by the army. Ten years ago the Liberty engine was the finest aircraft motor in the world, but engine building has progressed so far in the years since the war that the big twelve-cylinder Liberty is now branded a menace to aviators, besides being uneconomical to use. Congressman LaGuardia, of New York, a wartime flyer, was responsible for the decision to replace the surplus engines with more modern motors. He cited figures from General Fechet, chief of the army air service, to show that Liberty engines were three times as dangerous as the modern Wright "Whirlwinds" and "Cyclones," Curtiss "D-12's" and Pratt and Whitney "Wasps" and "Hornets." LaGuardia recommended that none of the engines be sold for use in civilian planes, and that they be converted into scrap. Some reconditioned Liberties have been sold for use in fast motorboats.

ROUGH ROLLER FOR HARD ROADS TO STOP SKIDDING

On some of the hard roads about Berlin, a specially constructed roller is applied to roughen the surface and thus reduce the likelihood of automobiles skidding. The plan in effect gives a tread to the road without damaging the material or causing discomfort in riding.



Rough Roller That Puts a Non-Skid Surface on Hard Road for Safer Auto Driving



Model of Airport Department of Commerce Prepared for Exposition in Seville; It Embodies the Latest Improvements

AIRPORT LIKE COUNTRY CLUB HAS MANY LUXURIES

For exhibition at the international fair in Seville, Spain, the department of commerce has prepared a model of an airport. It shows luxuries and conveniences commonly associated with country clubs, and similar places, and also has small replicas of most of the latest safety devices developed for aviation fields.

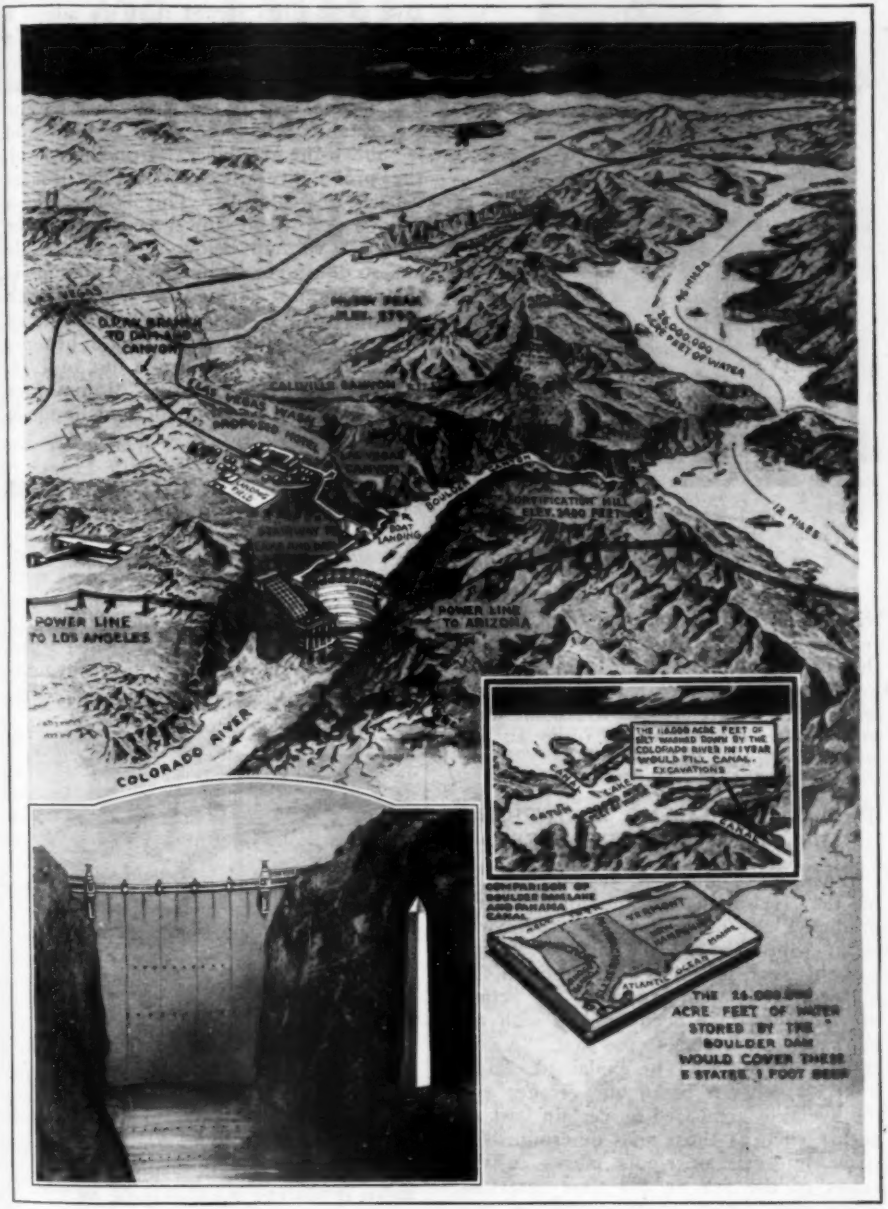
BOULDER DAM UP TO STATES BORDERING ON RIVER

With the passage of the Boulder dam bill by congress and its signing by President Coolidge, the greatest flood-control, irrigation and power-development scheme in American history is now up to the states bordering on the lower Colorado river, waiting for their acceptance of the terms. Under the bill, the government is to advance $165,000,000 to start the project, with the idea that the money eventually will be repaid out of power profits. If the states accept the terms and the dam is built, it will be the highest on the continent, taller than the Washington monument; will impound a mass of water sufficient to cover five New England states to a depth of one foot, and will stop the river from carrying down to the sea each year enough silt to fill the whole channel of the Panama canal. While the primary purpose behind the scheme is flood relief—to prevent the river from overflowing the immensely rich Imperial valley, a truck garden that once was the bottom of the sea and is now below the river level—the power developed is expected to pay for the work. As a side line, a hotel and resort may be developed on the west bank above the dam, from where boats can travel up to the Grand canyon. The site is not far from Las Vegas, a desert stop on the Los Angeles-Salt Lake air-mail and passenger line.

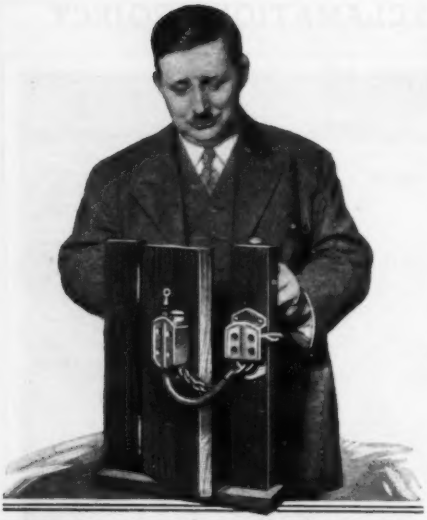
ALUMINUM MILK-BOTTLE CAP HELPS GUARD HEALTH

To keep dust and germs out of milk bottles, an aluminum cap with a hinged cover opening for pouring, snaps on the top of the bottle. It is easily adjusted and tightly seals the container.

AMERICA'S GREATEST RECLAMATION PROJECT



Bird's-Eye View of the Boulder Dam Site; the Grand Canyon Is Several Miles to the Right of the Storage Lake; Insets, the Dam Compared with the Washington Monument, and Visualization of What It Will Mean to the West



Model of Lock, the Chain of Which Contains Penetrating Gas Intended to Rout Burglars

CHAIN LOCK RELEASES GAS TO FOIL THIEVES

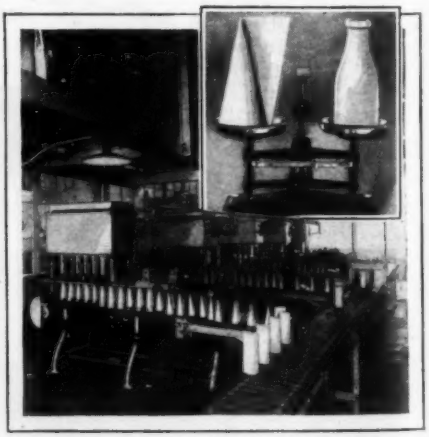
Fumes of penetrating gas are contained within the chain of a lock that an eastern inventor has introduced to discourage thieves. Should the chain be cut, broken or otherwise tampered with, the gas is released and is intended to overcome anyone who is attempting to force an entrance without a key.

PREDICT VOLCANO ERUPTIONS BY STUDY OF AVERAGES

When Dr. Thomas A. Jaggar, director of the Hawaiian volcano observatory, predicted, the other day, that there will be an eruption of either Kilauea or Mauna Loa this year, scientists paid attention, for his prophecies with regard to the action of volcanoes have been fulfilled with remarkable consistency in the past. "A volcano is not a clock," he explained. "The interval theory is based on averages and the averages are based on certain laws of nature such as those that determine the space intervals of ripple marks in the sands of the sea or the time intervals when they break rhythmically on the beach. The lava under a volcano has been pressing upward for ages through a crack of certain size. It has blocked or impeded that crack with its own heap of lava and so has forced itself to adopt a rhythm or interval like the puffs from a steam engine. If it has several vents, these divide responsibility for the interval, and if one vent is low and close to the water table, while the other is high and far above the ground water on the island, the probability of explosion is greater for the lower vent. This is because a sudden drop in the lower vent may place the lava column below the water table and so develop a steam chamber. This is the situation of Kilauea as compared with Mauna Loa." Doctor Jaggar predicted in 1912 that Mauna Loa would become active before 1915. It broke out in 1914. In 1920 both Kilauea and Mauna Loa erupted, according to predictions he made in 1917.

WOOD FIBER FOR MILK BOTTLES REPLACES GLASS

Lightweight bottles of paraffin-treated spruce fiber have been introduced as milk containers in place of the ordinary ones of glass. They eliminate the clatter, are easily opened and are tightly sealed when filled, to keep out dirt and to prevent tampering. Two of the cone-shaped holders,



Filling the Paper Bottles, and Comparison of the Weight of Two with One Glass Bottle, All Filled

filled with milk, weighed but seven ounces more than a full glass quart bottle.

The Bug Boarding-House

An "Apartment House" for Cockroaches in the Government Experimental Laboratory, Where All Kinds of Insects Are Studied

THE FANTASTIC sight of two chickens, each one clad in what actually looked like a nightshirt, careening about on a farmhouse lawn, was afforded two automobilists in the rural district of Vienna, Va., a short time ago.

"What does that prove?" exclaimed the astonished driver as he shut off his motor and took a closer view of the scurrying hens.

The answer, given by W. S. Abbott, was that they were now on the premises of what is probably a unique research farm in the country. Known variously as the "Bug Boarding House," "The Crawler Factory" and "The Insect Zoo," the establishment is used for the purpose of testing out all manner of chemical mixtures purported to rid the nation's households, gardens and farms of bothersome and destructive insect pests.

"Doctor" Abbott, as he is known, is the landlord of the boarding house, and he has been on the same job for about twelve years, his official title being entomologist, or insect specialist. Assisting him are three other entomologists, and the government has established a somewhat smaller bug farm at Lake Alfred, Fla., near Orlando, the idea being to study the southern insects, notably those that prey upon citrus fruits. In addition, the food, drug and insecticide administration, which supervises all the work, maintains some thirty collectors whose duty it is to tour the country in search of samples of insecticides to be turned in for investigation.

Far-fetched as the bug farm's nicknames may sound, they are not so much so when you come to examine the reasons for their origin. Certainly the place is an insect-boarding house, for there are apartment houses and a regular bill of fare for cockroaches; a two-story palace devoted exclusively to the fussy wants of clothes moths and carpet beetles, and, besides, two entire greenhouses filled with choice plants that offer the richest kind of desserts for the most discriminating outdoor moguls of bugdom.

As for being a "Crawler Factory," that term, too, is not so far from the truth. There's hardly an insect that a person could name off-hand that isn't to be found, and if it so happens that the supply of roaches, moths, fleas, lice, and so on, runs low, the experts practice the simple expedient of supplying such appetizing fare that in an amazingly short time, may be only a few days, the situation becomes normal.

Then again, the name "Insect Zoo"

Testing Out Insect Eradicators in One of the Greenhouses of the Laboratory Where Pest Extermination Is Studied

comes pretty close to the real facts in the case. Whereas, in an animal zoological park, the monkey frolics about a tree while the duck cavorts in a pond, a similar situation prevails among the bug-farm inhabitants. Within its exclusive mansion, the cockroach may play hide and seek among the cracker boxes and refuse of various kinds that simulate almost exactly the conditions in its natural habitat; the hungry clothes moth, surrounded by a goodly supply of raw wool and woolen cloths, has far better quarters than he would have normally, and the rest of the bug family are treated with like consideration. For instance, the itinerant animal parasites, such as those fleas and lice that gnaw on dogs, cats and chickens, are bred in substantial numbers by the simple process of letting them roam around at will on the haunches of animals raised especially for the purpose.

Those two staggering hens with the "nightshirts" on were taking part in a curious test. The experts had followed out literally the directions of a lice cure, which recommended that cheesecloths, that previously had been dipped with a certain kind of chemical mixture, be wrapped around the hens. It killed the lice, sure enough, and killed a lot of chickens, too. Almost equally tragic results, though of a somewhat different sort, have come about occasionally during experiments concerning the lowly bedbug. There was a time when the wee crawlers were bred in the bug-boarding house on a rather large scale. Not so today, however, and possibly such happenings as the following may serve to explain why. It seems that bed cooties can live on many kinds of animals, notably white rats, or so the experts believed in the early days. Therefore, in order to encourage their development, the seemingly clever idea was hit upon to build up a sizable partnership between the bugs and rats.

All went well for a while. But soon the scientists were taxing their brains to solve the strangest mystery of many a day. The bedbugs were disappearing fast and no legitimate reason presented itself until one alert expert noticed to his astonishment that, instead of the crawlers thriving on the white mice, the latter beasties were chewing away steadily on their erstwhile biters. This sort of thing couldn't go on. So the practice of trying to breed the bedbugs stopped, and the fact was made known officially that Uncle Sam hereafter would buy them at the modest price of a penny apiece. Yet there weren't any too many bug hunters willing to sacrifice time and energy for that sum. Whereupon the price jumped up to a copper and a half. Even then the situation was hardly as it should be, although there actually were a few people of extra-fine eyesight who not only claimed they could supply 2,000 bugs upon twenty-four hours' notice, but were able to make good on the boast.

This bedbug story, however, had an unexpected ending. Doctor Abbott one day mentioned, in a Washington barber shop, that the government was in the market for a supply of the bugs at a cent and a half apiece. A stranger standing by offered to assist in getting the collection started, but his assistance took the form of passing the story on to a newspaper reporter, who wrote a highly interesting account of Uncle Sam's offer to pay for the pests. Papers throughout the country reprinted the yarn, sometimes adding embellishments of their own, with the result that large shipments began to arrive from all quarters of the country. It was necessary to get out a special form letter assuring aspiring dealers that the government did not need any more insects and would gladly return those already sent, provided the shipper sent return postage.

Not all the martyrs to science get their names in the daily press. It is all in the day's work for an insect investigator on the bug farm to be called upon, of a summer's evening, to go out in the swampy woods where mosquitoes are thickest and "park" there for hours, meantime letting the stinging insects try their luck both on an arm that has been treated with a so-called mosquito-proof lotion and on one that has no such protective substance on it. Unhappily, this procedure has to be carried out because it is one of the best ways to test the efficacy of many much advertised commercial remedies. The idea is to compare the number of bites received on each arm.

Trying Out Flea Cures on a Cat and Dog, and, Center, a Plant Ravished by Aphids About to Be Sprayed

Gas masks are common enough in mines. But who ever heard of using such protective coverings for "shooting" cats and dogs with flea and lice remedies? Nevertheless there are frequent occasions when the bug experts must put on a funny-looking mask, known as an "aspirator," that fits over the nose and mouth. Without it, they would be more than likely to get their nose and throat so filled with strong chemicals that very soon they would manifest all the symptoms of the

Chickens Wear "Nightshirts" in a Test in Which the Garment Is Saturated with an Advertised "Remedy"

true possessor of hay fever. It seems rather a shame that no such contraption has been devised for the use of the animals that must undergo the tests, but thus far there has been none that has entered the situation seriously.

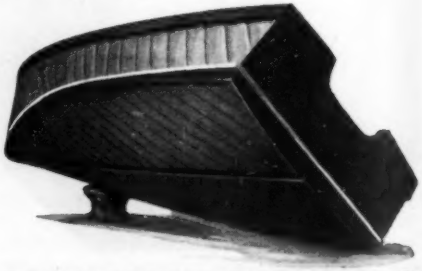
The dog shown with "Doc" Abbott in the picture, is only a mongrel. But its service to science during its five-year stay with Uncle Sam has been important. Sad-eyed and quiet, it has figured in all sorts of tests. In one of the very latest, it was adorned liberally with fleas, wrapped carefully within a piece of sacking and then put into a box sprayed with a new kind of flea cure. Only the faithful dog's head was left sticking out and it presented an exceedingly sorry picture. However, it bore the ordeal with bravery and earned further high rank as a star boarder in the bug house. In this regard the cat family is far more "persnickety" than are the dogs. Five kitties are kept at the farm to be covered now and again with sundry fleas and lice closely related to the dog varieties. But, as every one knows, cats bitterly resent having any kind of liquid poured on them; which explains why only the powders are used ordinarily. Even these are not welcomed.

Lice aren't by any means confined to animals. Plants have them, too, and in great abundance, variety and in most colors of the rainbow. Known as aphids, the size of these strange insects also varies widely, some being so tiny as to be barely distinguishable to the naked eye, and others up to about an eighth of an inch long. Though most aphids are green, the color seems to depend mainly on that of the particular plant on which they live.

One of the most novel of the recent experiments at the bug-boarding house was designed to test the effect of a substance, to be taken internally, which would not only rid chickens of lice, but, in case the said poultry were gobbled up by hawks or owls, would likewise kill these animals. The experts gathered a few of these last and fed a couple of chickens to them after the latter had imbibed of the magical powder. But something revolutionary must have happened to the "remedy," for the hawks and owls seemed to thrive on their unusual fare even when the powder dose was increased up to eight times the amount called for.

BOAT FOR SHALLOW WATERS HAS "STEPS" ON KEEL

Weighing slightly more than 180 pounds, an outboard-motor boat introduced in England, will run on water but three inches deep when it is empty. The keel is arranged with overlapping members and the sides are built in the same manner to decrease resistance from the water when the craft is going forward. It will hold several persons.



View of Keel of the Outboard-Motor Boat, Showing the Overlapping Members on Bottom and Sides

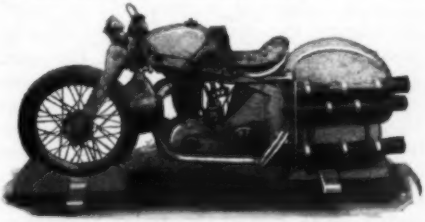
Model of a Working Grain Elevator on the Chicago River, and, Inset, the Car-Loading and Unloading Side, with Railroad Sidings

MODEL ELEVATOR LOADS CARS AND LAKE STEAMSHIPS

The millions of bushels of grain which each year pass through the control of the world's greatest grain market, the Chicago Board of Trade, require a vast amount of handling machinery to permit weighing, checking and speedy shipment. The huge grain elevators can load or unload either railroad cars or lake steamships at the same time, and weigh every bushel of grain that goes in or out of the bins, all in one operation. One of the sights of the weighmaster's office is a scale model of an elevator, rail car and steamship, cut away to show actual operation. Grain can be run into and out of the bins, and to and from the car or steamer holds, and accurately weighed as it passes. The unloading of railroad cars is accomplished on a dumping track, similar to those used to empty coal cars. The Board of Trade differs from stock exchanges in one important particular, for, while stock brokers may never see the actual shares they buy and sell, a sample of every car of grain entering the Chicago market goes to the trading floor for examination. Both Board of Trade and state inspectors pass on the grading and insure the genuineness of the sample as representative of the lot.

MOTORCYCLE RUN BY ROCKETS SHOWN AT EXHIBITION

One of the interesting displays at a recent motor exhibition in Germany was a rocket motorcycle. For the first time, the general public had an opportunity to examine this unit closely. The cycle has passed several successful tests.



Rocket Motorcycle Shown at German Exhibition; Note Chambers and Powder Containers at Rear

ZOO GOATS' MODEL MOUNTAIN KEEPS ANIMALS IN TRIM

Goats in the San Diego Zoo on Top of Their Artificial-Mountain Playground Erected in Pen

To give mountain goats the exercise they need, an artificial cliff has been erected in the animals' pen at the Balboa park zoo in San Diego, Calif. A spiral runway leads to the top of the crag, and there are projections to which the animals may jump. The goats enjoy the climbing and their nimbleness attracts visitors.

SOLVE RADIO MYSTERY

While stirring beans on her electrical stove, a California woman was mystified at hearing the strains of three musical selections coming from under the pan. The phenomenon remained a mystery until investigation led to the following explanation: The music was picked up by induction from a telephone wire by the current circuit that supplied the range. It was then fed to the metal resistances in the stove where the audio vibrations were loaded upon the heat vibrations which carried them to the thin metal disk of the pan. The stirring caused the musical vibrations to come up from under the beans. It would have been possible, in the opinion of engineers, for the hot air alone to have reproduced the music.

LIGHT RAYS CONTROL TRAIN TO PREVENT WRECKS

German engineers are testing a light-ray safety-control system for railroads. A selenium cell is an important unit in the apparatus and along the right of way are mirrors, of special construction and said to be reliable under all weather conditions. Rays emanating from the locomotive cab strike the mirrors as the train proceeds. If there is danger ahead or the next block is closed, the rays affect the selenium cell in such a way that an electric circuit is closed and the train's brakes are automatically applied. The train is brought to a stop gradually by varying the distance between the mirrors. The system has been recommended for installation at curves and other places where slower speeds are in keeping with greater safety.

PUNCHING BAG WORN ON HEAD AIDS SHADOW BOXER

As a substitute for the regulation punching bag, a rubber sphere, attached to a headband by rubber cords, and worn in front where it can be struck by the fists, has appeared on the market. It is said to afford healthful exercise, gives practice in shadow boxing and is noiseless. Should the user miss the ball, he would suffer no injury as the sphere is of light weight.

Shadow-Boxing Practice with Lightweight Rubber Ball Attached to Head with Rubber Band

ALL-STREAMLINE PLANE FLIES AT GREAT SPEED

Interesting Views of the Streamline Plane Built for Fast Speed and Greater Comfort; Note the Guards about Landing Wheels

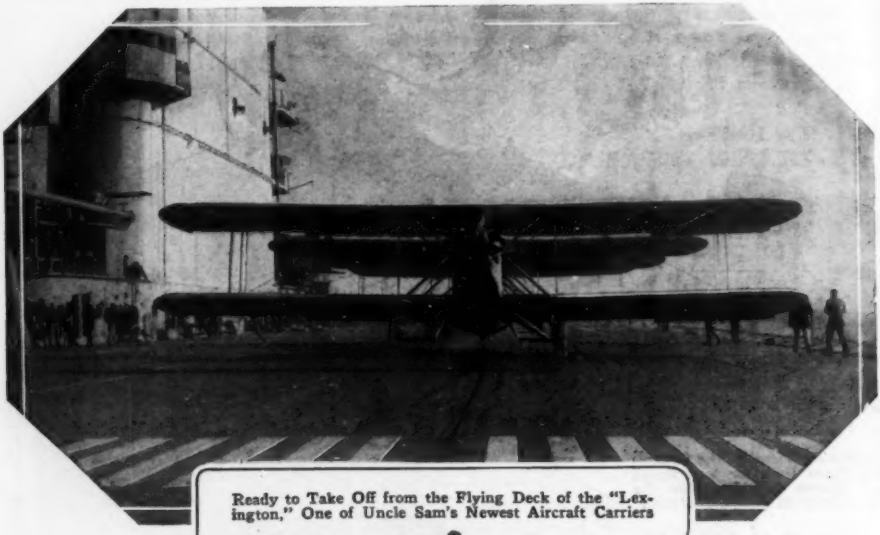
Absence of struts, unusual development of streamline design and the low position of the wing are special features of a monoplane built by a western engineer. It has flown at 200 miles an hour with its single motor and has climbed to a height of 1,000 feet within the first minute after leaving the ground, according to reports. Landings at forty miles an hour are made. The fuselage and wing are covered with plywood. The plane has a wing spread of thirty-five feet.

"COLDEST SPOT IN THE WORLD" FOUND AT HELIUM PLANT

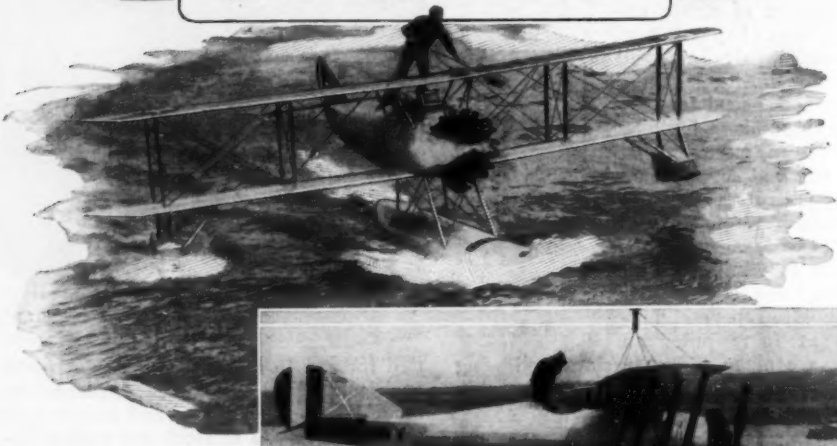
Near Amarillo, Tex., the bureau of mines is constructing a plant for obtaining helium from natural gas and when it is in operation, it will be one of the world's coldest places. Three hundred degrees below zero will be the normal "weather" in this laboratory, for at that point other substances than helium in the gas are liquefied and can be drawn off, leaving the helium, which is carefully saved and bottled for use in inflating airships. Under such cold, air is also liquefied, carbon dioxide becomes solid, lead and copper take on the properties of steel, and rubber becomes as brittle as glass. An icicle, thrust into the gas at such a temperature, would produce about the same effect as when a hot poker is immersed in water. Improved manufacturing processes are reducing the cost of helium to but a fraction of what it was when the gas was first employed for aeronautical purposes.

¶Names and addresses of manufacturers of articles described in this magazine will be promptly furnished, free, by our Bureau of Information.

SEAGOING FLYING FIELDS AND SALT-WATER



Ready to Take Off from the Flying Deck of the "Lexington," One of Uncle Sam's Newest Aircraft Carriers



Landing a Seaplane Alongside Ready to Be Hauled Aboard Again, and the Plane Being Hoisted to the Deck; Seaplanes Are Shot from the Carriers, as Well as from Battleships and Cruisers, by Catapults, and When They Return Alight Alongside in the Water; Land Ships, However, Can Fly Directly from the Broad Flying Deck and Return to It, Hooks beneath the Landing Gear Engaging Arresting Apparatus to Bring Them to a Stop

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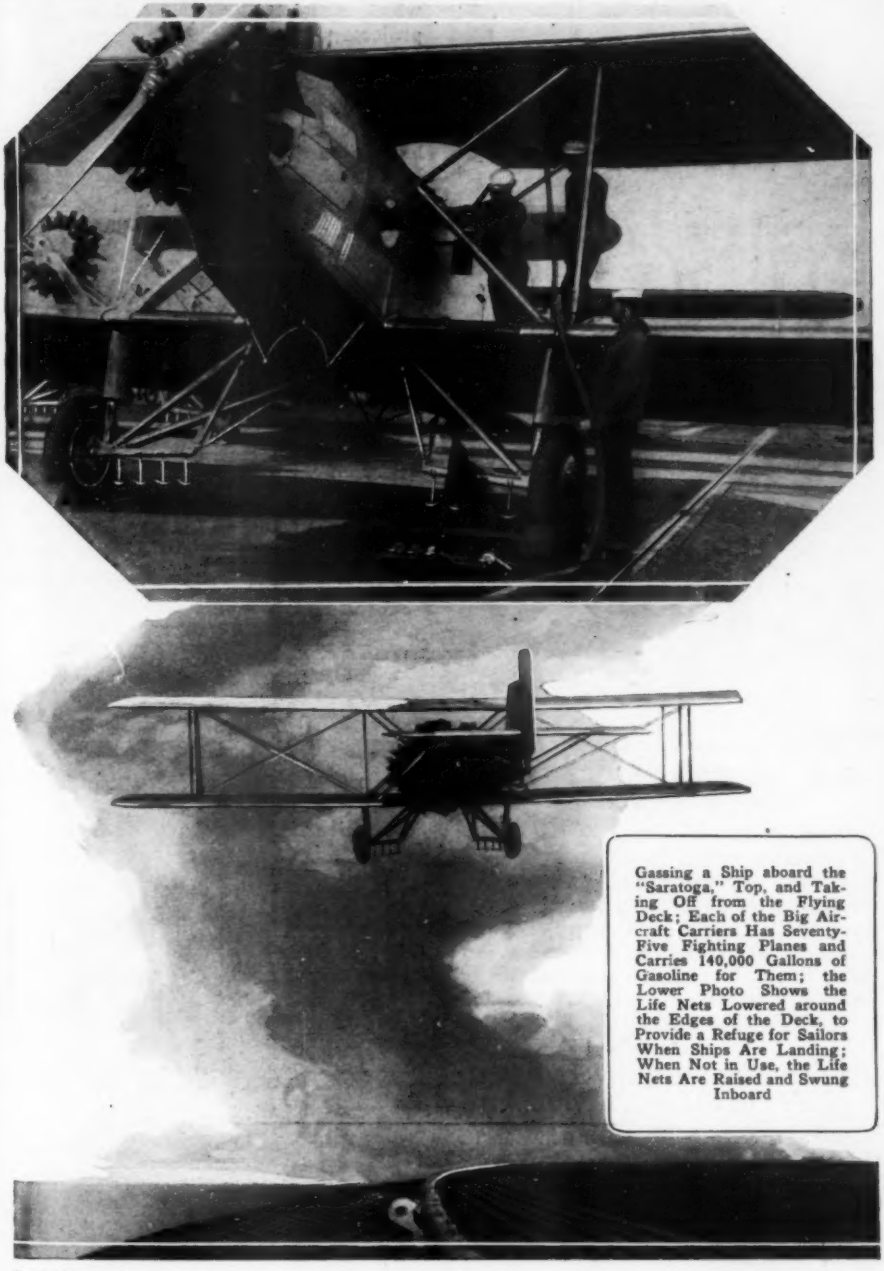
AIRMEN WITH THE FIRST LINE OF DEFENSE



Gassing a Ship aboard the "Saratoga," Top, and Taking Off from the Flying Deck; Each of the Big Aircraft Carriers Has Seventy-Five Fighting Planes and Carries 140,000 Gallons of Gasoline for Them; the Lower Photo Shows the Life Nets Lowered around the Edges of the Deck, to Provide a Refuge for Sailors When Ships Are Landing; When Not in Use, the Life Nets Are Raised and Swung Inboard

R. U. Thompson

Drawing to Show How Stilts Were Installed in Building and Addition Erected on Top of Them

ADD STILTS TO OLD BUILDING FOR EXTRA STORIES

Although it was not constructed for adding more floors, an office building in New York city was raised six stories recently by a skillful engineering plan. This involved erecting eight columns, 175 feet tall, inside of the old building, to support the addition. The work was accomplished without disturbing tenants and was finished within six months.

NEW VISUAL THEORY OFFERED BY SIR OLIVER LODGE

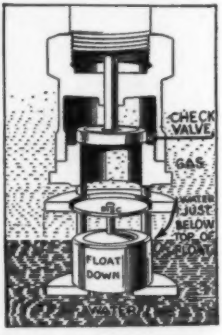
How do we see? The phenomenon of vision is given a different explanation by Sir Oliver Lodge who witnessed a series of tests showing the effect of electric shocks on the nervous system. He suggested that radiation alone is not the whole cause of vision but that the retina of the eye possibly contains something which ejects electrons and these act as projectors to stimulate the nerves. This stimulation from the electrons, rather than the impact of the light waves, Sir Oliver holds, may cause vision. His explanation was inspired by the fact that some high-frequency electric currents could not be felt when applied to the body of the subject in the test, but did produce an effect on the nervous system.

PRINTER'S ERROR ADDS VALUE TO POSTAGE STAMP

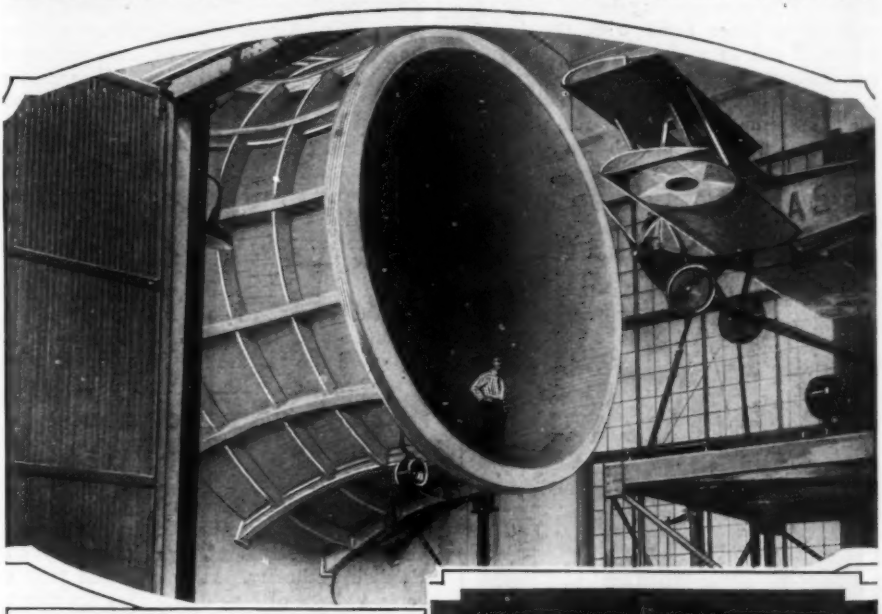
Mistakes usually are costly but they may mean small fortunes to stamp collectors. An illustration is furnished from France. Recently, a government printer carelessly tore a roll of blank paper on which the stamps were to be printed. He mended it with a strip of red paper. When the stamps, which were printed in green, were finished, ten of them appeared on a red background. They are already highly valued by collectors and doubtless will increase in price.

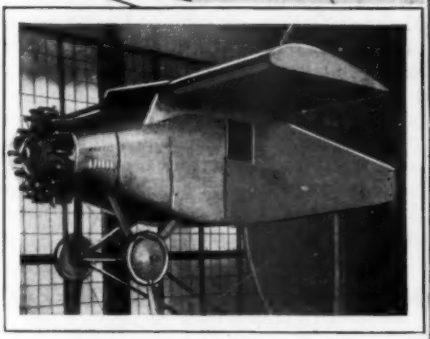
WATER KEPT FROM GASOLINE BY SAFETY VALVE

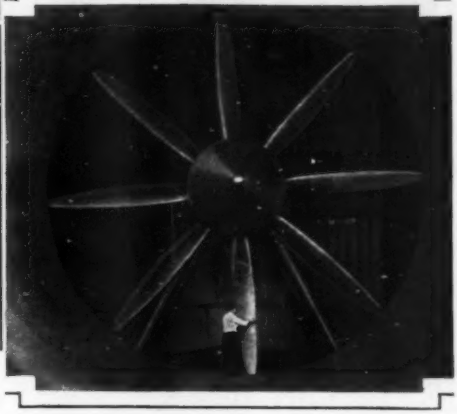
To prevent pumping water into the automobile gasoline tanks from filling stations, a special valve has been devised to fit on the end of the suction line inside the station tank. Its essential feature is a float which sinks in gasoline but rests on water and locks the pump before water at the bottom of the tank can be drawn into the customer's auto. The station attendant can quickly pump out the water in the tank, thus allowing the float in the suction-line valve to fall back and unlock the gasoline pump. Rust, dirt and scale in the bottom of the tank are also excluded by the valve, which is made of bronze.



WHERE LATEST DESIGNS IN PLANES ARE TESTED







Views in the Plane-Testing Laboratory at Langley Field; the Huge Wind Tunnel, One of the Planes Tested and the Large Fan

Unusual experiments that will have a far-reaching effect on airplane design are being conducted at Langley field, Va. The air resistance of the increasingly popular radial air-cooled aviation motor, which now is one of the most serious drawbacks of this type of airplane power plant, is reduced by more than thirty per cent by a radical change in streamlining the cowling, which diverts the propeller slip stream around the motor and yet does not interfere with the cooling. The increase in efficiency resulting from this change is said to be the most valuable aviation improvement since the World War. Wind-tunnel investigations have revealed that twenty-five horsepower is lost in overcoming the wind resistance offered by the motor, without streamlining. Therefore, the new cowling increases the effective horsepower of the plane by approximately eight horsepower. The saving, in the case of a 200-horsepower motor, for example, amounts to

three gallons of gasoline to the hour of flight. The new cowling device, which resembles a large bowl with the bottom knocked out to make room for the propeller shaft, is placed over the engine. It is the first result of a cowling and cooling investigation undertaken in the new $150,000 propeller-research tunnel.

ROLLER SKATES SPEED PHONES IN EARLY HOURS

Telephone Girls in Los Angeles Exchange Wearing Roller Skates to Save Time in Answering Calls

Young women on duty in the early morning hours at a Los Angeles telephone exchange, wear roller skates to speed them in moving to different positions at the boards. The plan is reported to have been successful, as it saves time when only a few attendants are at work.

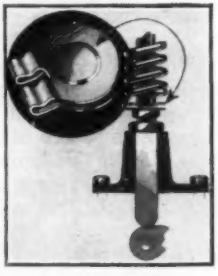
ANCIENT BURIAL PIT REVEALS ROYAL SPLENDOR

Splendors of a royal court that flourished 5,000 years ago have been unearthed in the cemetery of Ur of the Chaldees, where the bodies of forty-five sacrificial victims, thirty-nine of them women, have been found by excavators. The discovery revealed an amazing display. There were gold hair ribbons, wreaths of gold leaves and flowers, inlaid pendants, large ear rings, combs with flowers of colored inlay, pins and necklaces of gold. Among other objects were three harps, one adorned with the golden head of a bull, and the statues of a pair of rams, their heads and legs of gold, the horns and hair of lapis lazuli and the fleece of white shell. The statues have sockets which indicate that they once were the support of some article of furniture or ornament that long since has disappeared. After the bodies of the sacrificial victims had been placed in the pit, earth had been heaped on them and tamped down, while other possessions, servants and live stock were buried to complete the ceremony.

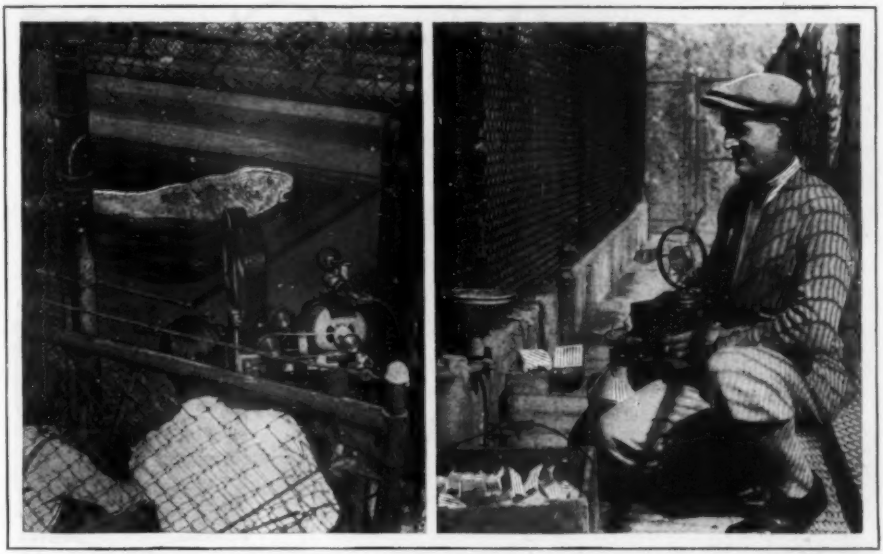
MAGIC EFFECT OF COLOR KEEPS STEEL COOL

That color may be employed indirectly to increase the strength of some structures is the interesting conclusion suggested by a series of experiments by an English authority. He has found that a certain shade of blue diminishes the effect of the sun's rays on steel and preserves a more even temperature. Since extreme heating and cooling may tend to weaken a structure, under certain conditions, the proper color might insure longer life and greater strength. Physicians long have recognized the importance of the right color in hospitals and sick rooms and in the home, the use of color in decorations being studied more carefully.

SPRING CLIP FOR VALVE TAPPET ELIMINATES NOISE



To stop tappet noises in cars which have developed that trouble, a spring-steel unit is inserted between the valve stem and the tappet head. Once in place, it holds the tappet in constant engagement with the camshaft and can be installed in a few minutes.



Polar Bear Performs for the "Talkies"; the Recording Apparatus Was Placed at the Open Door of the Bear's Cage While the "Mike" Was Held near the Screen

POLAR BEAR IN TALKING MOVIES PROVES GOOD "ACTOR"

To obtain "talking" moving pictures of a polar bear at the zoo in Oakland, Calif., photographers placed their machines close to the animal's cage and then opened the door so they could film close-ups of the inmate. The bear seemed to enjoy its brief experience as an "actor," jumping in and out of its pool and giving a few roars and grunts which were recorded for the talkies.

MOON LIKE VOLCANIC ASHES TEMPERATURES SHOW

No one knows for sure of what the moon is made, but temperature tests during the last eclipse indicate that it is composed of a porous substance possibly not unlike the volcanic ashes common in various parts of our earth. Scientists are quite certain that the moon is not like solid rock in structure. Drs. Edison Pettit and S. B. Nicholson, of the Mt. Wilson observatory, made careful measurements of the cooling of the moon as it went into the earth's shadow. Similar measurements were made in a laboratory as to the cooling of substances such as granite, basalt and quartz. The material that cooled in a manner most like that of the moon was pumice, a porous stone of volcanic origin. The tests further substantiate the theory that the craters on the moon were caused by volcanoes.

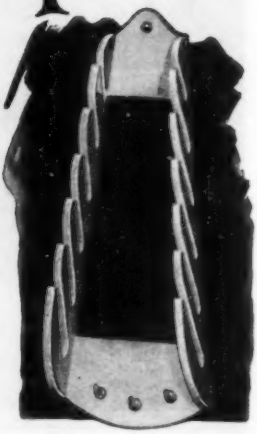
PAPER-COVERED FOOTRESTS AID SHOE-STORE CUSTOMERS

One of the latest conveniences for the shoe store is a footrest with a reel of paper that is unwound as needed to provide a fresh, clean surface for the patron's stockinged feet. The reel carries sufficient paper for many days, and the stool is of such shape and size as to be handy and comfortable.

¶The Popular Mechanics' Bureau of Information offers its free service to all readers of this magazine. Names and addresses of manufacturers and dealers in articles described, and any other details in our possession, will be promptly furnished.

New Ways to Avoid

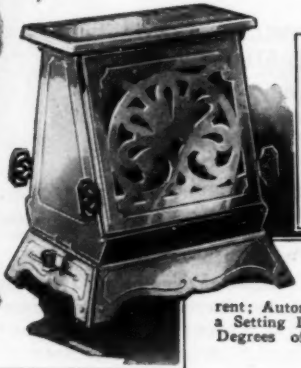
Small Electric Range and Broiler Combined Takes Anything Up to an Eight-Pound Roast, Reduces Current Consumption and Saves Time; the Top Part Has a Three-Compartment Steamer for Vegetables



Pot Covers of Different Sizes Are Conveniently Held in This Wall Rack of Enamel; It Also Has Hangers for Spoons

Extra Service Is Rendered by This Double Strainer with Two Sieves; They Come Apart without Difficulty for Washing

This Portable Gasoline Heater Can Be Swung at Different Angles for Better Direction of Its Warmth; It Is Safe and Simple



To Prevent Burning of Toast and to Save Current; Automatic Electric Toaster Has a Setting Device for Giving Different Degrees of Brownness, and Turns Itself Off

Home Drudgery

Small Electric Washer Can Be Installed beside the Washbowl in Bathroom, or Other Convenient Place; Cleanses All Sorts of Garments and Will Take Bulky Articles Like Sheets and Pillow Cases

Mop Wrung by Crank Instead of in the Usual Way Has a Mechanical Hand That Holds the Cloth Flat against Floor Surface When in Use

Washing Dishes without a Pan: This Handy Mop Has Space for Soap in the Base of Its Grip and Uses Odd Pieces to Reduce Waste

Inner Solid Wheel Resting on Block, Shows How Bus Is Supported if Outer Tire Is Punctured

SAFETY WHEELS FOR MOTOR BUS AID IN BLOW-OUTS

Small emergency wheels with solid tires are attached inside the regular wheels on motor busses of a western line. Should the tires blow out, the smaller wheels would support the load until the bus could be halted and repairs made, thus reducing the likelihood of overturning on curves or while running at high speed. The wheels can be attached in a few moments.

A CORRECTION

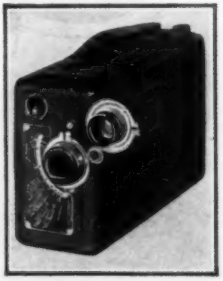
In an article on "Women of the Air" in the January issue reference was made to Glenn Curtiss as the inventor of the aileron, thereby doing an unintentional injustice to Dr. William W. Christmas, of New York, who was the first man, after the Wright brothers, to fly a plane, and who invented the form of aileron now universally used, as a movable section of the main wing. The error was due to a mistaken understanding that the Curtiss plane, with interplane flaps, which he flew on June 26, 1909, was the first practical ship to get away from the Wright system of wing warping. A search of the records since discloses that Doctor Christmas used ailerons on a plane which he flew March 8, 1908, and that these ailerons closely resembled the modern article, the patent on which he sold to the United States government.

FORECAST INVASIONS OF PESTS TO PROTECT CROPS

Predictions of insect-pest invasions may be broadcast like the weather forecasts, if plans being developed by Roy Melvin, at the Iowa State college, materialize. By careful observation of the temperatures during the winter, measurements of the amount of oxygen consumed by the eggs and larvæ of insects in the cold season and comparing these factors, he has worked out a method of calculating the percentage of insects likely to survive the winter. Last year his forecasts on the abundance of corn borers were verified later in the season.

AUTOMATIC FOCUSING POSSIBLE FOR HOME-MOVIE CAMERAS

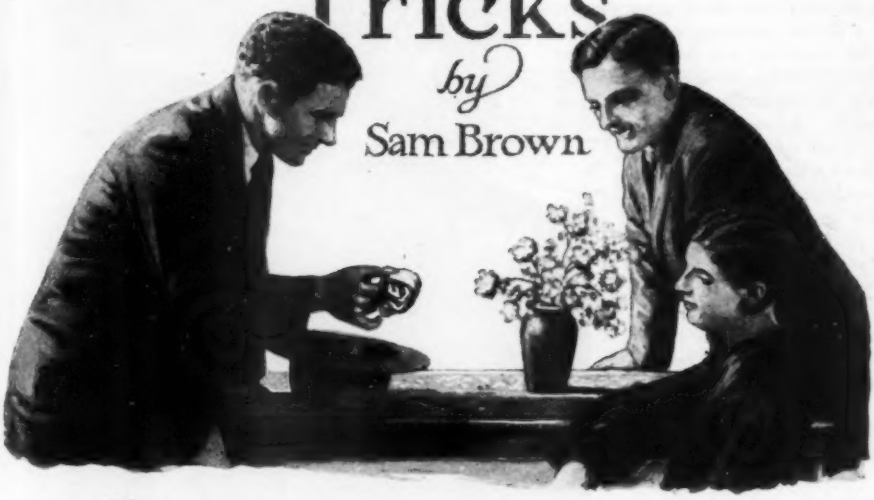
A device which makes it as easy to keep a movie camera, or any type of ordinary film or plate camera, in accurate focus on a moving object as it is to do it with a focal-plane shutter camera, is now available for amateur photographers. It consists of a fast lens and shutter, fixed in a micrometer mount and focusing on a prism, on which the picture can be seen through a magnifying eyepiece which enlarges it about ten times. A train of gears can be added to automatically keep the camera lens in the same focus or, for slower work, the device can be focused, the exact distance to the object read from a scale, and the camera lens focused to the same point. A micrometer adjustment permits movement of the prism toward or away from the lens, so that it is possible to match the exact distance between the camera lens and the film plane, and then use it to check other lenses to the camera, as the lens of the device is easily removed to set other lenses, such as a telephoto, in its place for accurate focusing.



¶Reindeer were imported to America as early as 1892.

Easy Handkerchief Tricks

by Sam Brown



I KNOW, Amos; most people think that handkerchiefs have no other business than noses, but listen.

The performer collects all the handkerchiefs present. We'll say there are four. He drops them into his hat. He shakes them up. Then comes the trick. Without even as much as a single glance, the performer removes each person's "hanky" as he calls for it.

Isn't that a lot more mysterious than noses? And it's dead easy. The first handkerchief is gripped through the felt; the second one is pushed up under the lining; the third is the performer's own, rolled into a compact little ball so as to be

The Stretched Handkerchief Makes Big Ones Out of Little Ones, and, Top, Any Owner Can Get His Property Returned from the Hat without the Performer Even Looking at It

distinguishable from the others; the fourth is simply dropped in. Well, with a layout like that, all the performer need do is remember which hanky is which and distribute them accordingly.

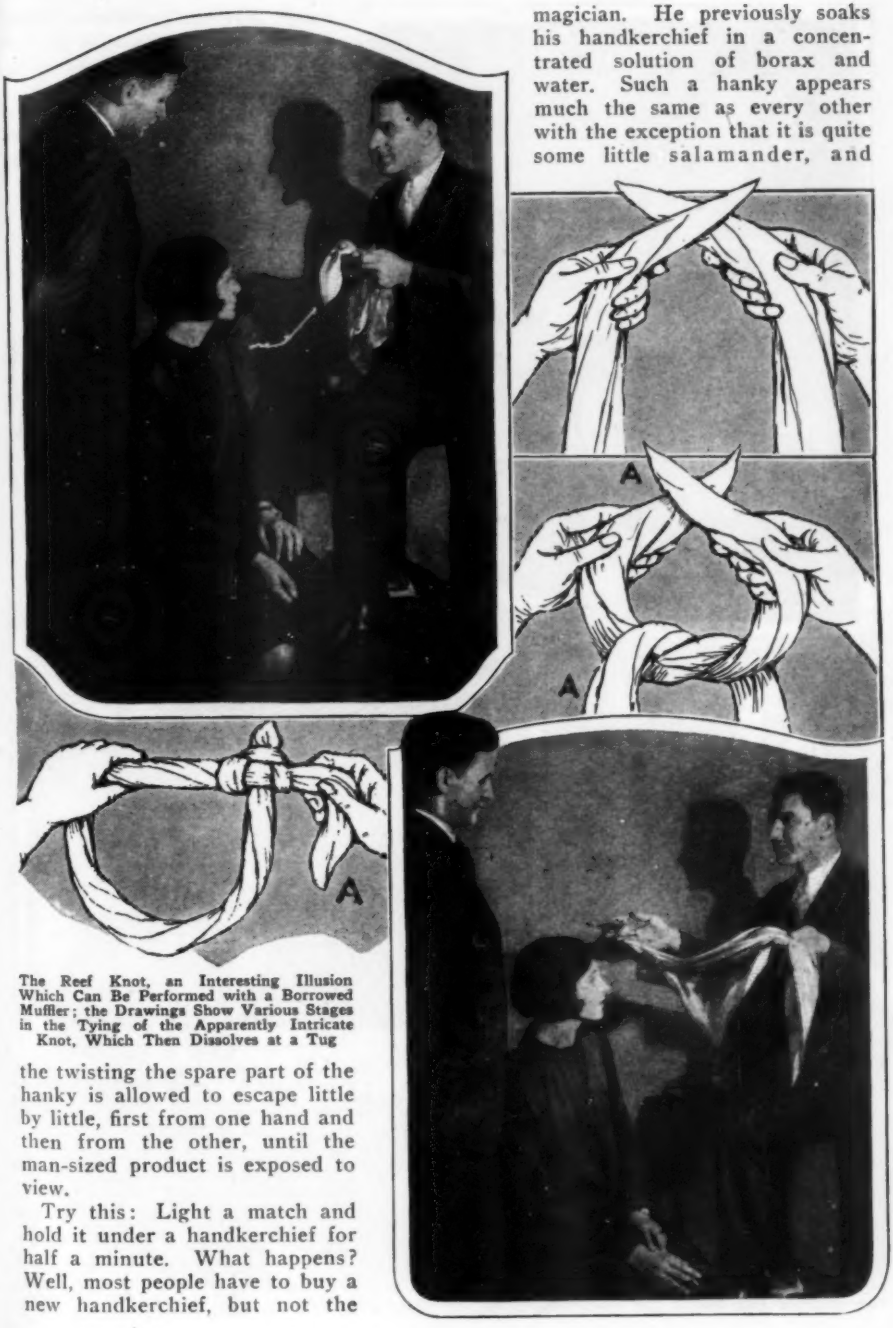
"Rudy" Kipling tells us how the elephant got his trunk, but he gives no recipe for making big handkerchiefs out of little ones. Allow me.

The performer borrows a handkerchief. Remarking that it seems a bit small, he twists it tightly—rope fashion—between his hands. In full view, the little hanky stretches out and becomes a full-sized handkerchief for the benefit of an amused audience.

It's done like this: The handkerchief is first taken by the extreme ends between finger and thumb of either hand. It is held slack. The performer then twists it up into a rope, and under cover of the rapid movement, the hands are for a moment turned backs downward, so that the handkerchief lies across the hands. The little fingers at once curl inward, as shown, and the hands are again turned backs upward. And what have you? The handkerchief now lies with a doubled-up portion of the ends concealed in either hand, although its appearance is much the same as it was before.

To stretch the handkerchief, the twisting is carried on, and during

Two Stages of the Stretched-Handkerchief Trick, at the Top, and, Bottom, Trying to Burn a Bit of Fireproofed Linen



The Reef Knot, an Interesting Illusion Which Can Be Performed with a Borrowed Muffler; the Drawings Show Various Stages in the Tying of the Apparently Intricate Knot, Which Then Dissolves at a Tug

the twisting the spare part of the hanky is allowed to escape little by little, first from one hand and then from the other, until the man-sized product is exposed to view.

Try this: Light a match and hold it under a handkerchief for half a minute. What happens? Well, most people have to buy a new handkerchief, but not the magician. He previously soaks his handkerchief in a concentrated solution of borax and water. Such a hanky appears much the same as every other with the exception that it is quite some little salamander, and

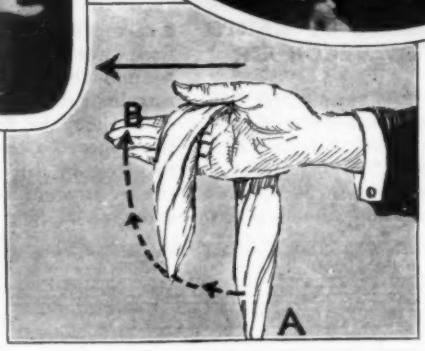
The Penetrating Coin, Which Apparently Passes Right through a Twisted Handkerchief; the Sketches Show the Working of the Trick, and the Circle Inset, the Right Thumb Making the Double Fold

doesn't seem to mind exposure to a match flame the least little bit.

The performer takes someone's beautiful silk muffler, and ties the ends tightly into knots. Gr-r-rr! Does the owner of the muffler get mad? He does not! For the performer simply passes the silk square behind his back and the knots obligingly melt away!

A knot, called a reef knot, is at the bottom of the whole business. Like this: The first knot is made by passing the end of the handkerchief in your right hand behind the opposite end held in the left hand, as shown. In making the second knot, the end in the right hand is passed in front of the opposite end in the left hand, as illus-

trated. Such a knot looks discouragingly wrapped up in itself, but if you will take the two ends AA and pull, you will get the reef-knot effect as pictured. In this form, the knot can be slipped off instantly and with one hand, while you are holding the silk behind your back.



The Final Step in the Penetrating-Coin Trick, Top, Right; the Juggling Trick, Above, and, at the Right and Below, the One-Hand Knot, Tied by Flipping the Hand

Here's a good one! The performer takes a coin in his right hand and covers it with a handkerchief. The coin is then twisted tightly within the hanky, but, no, the magician pulls it right out again!

Do it this way: Hold the coin in your right hand at the tips of the thumb and first

finger. Cover it with the handkerchief. Then, to show that the coin is still there, you stretch the hanky tightly over it, using the thumb and first finger of the left hand, as shown in the back view. And therein lies the whole trick. Notice that the thumb of the right hand passes over the left-hand thumb, and then grips the coin through the fold.

Not satisfied yet, the performer lifts up the corner of the handkerchief next to the audience and shows the coin still underneath the cloth. And now, with a quick flourish, the performer shakes out the handkerchief, still retaining his grip on the coin. This brings the coin to the outside of the now diagonally folded handkerchief, as shown. It is wrapped up in this condition and then removed by simply untwisting the handkerchief and sliding the coin out into view. Try it!

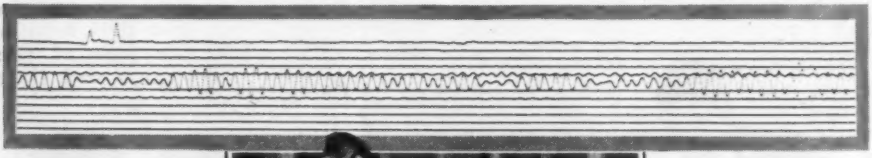
Balancing a handkerchief upright on your hand is a smart juggle which is quite puzzling. Of course, your audience is unaware that you have twisted a stiff piece of fine wire inside the handkerchief to give it the necessary rigidity to sustain its own weight.

Most people find it hard enough to tie a knot with two hands. So, try to imagine that awed look of amazement when the magician, with a sudden outward flip of his hand, ties a knot in the center of a large silk handkerchief.

This little interlude is quite easy. Hold the handkerchief as shown. A quick forward movement of the hand will bring the end A around so that it can be gripped between the first and second fingers at the point marked B. Holding the end A at the point B, the performer gives the handkerchief a quick outward toss, the knot magically forms in the center, and there you are!

SLIGHTEST TREMORS OF EARTH SHOWN ON NEW RECORDER

Earth vibrations as slight as one ten-thousandth of an inch are registered on a new recorder which is being tested in a government laboratory, thirty-five feet below the surface of the ground. Records are made photographically, the displacements or vibrations being shown 1,000 times greater on the record than they are during the actual movements incident to a quake. Study of the tremors with this and other instruments has shown that the shocks travel at tremendous speed, at least four times as fast as the swiftest airplane or automobile, and some of the first waves will pass a quarter of the way around the world in ten minutes. The new instrument detects earthquake waves which may be flowing from one side of the sphere to the other, and is expected to prove of still further aid in predicting the occurrence of quakes that might be disastrous. Scientists keep track of the normal variations in earth movements and are sometimes able to issue warning when unusual tremors are about to take place.



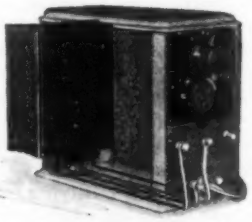
Quake Register in Government Laboratory below the Ground, and Sample of the Record It Makes

¶Names and addresses of manufacturers of articles described will be promptly furnished, free, by our Bureau of Information.

Greater Selectivity for the Old Set

Sets that may have been amply selective a year or so ago now fail to separate the crowded broadcast channels. Selectivity is, of course, a matter of circuit design, the present-day set being selective because it has low-resistance circuits, well-shielded tuning units and the tuning condensers now used have the proper capacity variation. There are several ways of sharpening the tuning of the old set, however, without making any radical changes. A variable high resistance, shunted across the antenna and ground posts, reduces the signal pick-up from powerful locals when the operator is trying to cut through for distant stations. Another method is to make the detector less sensitive, which may be done by substituting a variable grid-leak for the fixed type or by placing a variable high resistance across the grid and grid-return terminals of the detector socket. Shielding will add materially to the efficiency of the old set. This may be done by lining the cabinet with tinfoil, shellacked to the inside for general shielding, and by providing metal partitions between the tuning units.

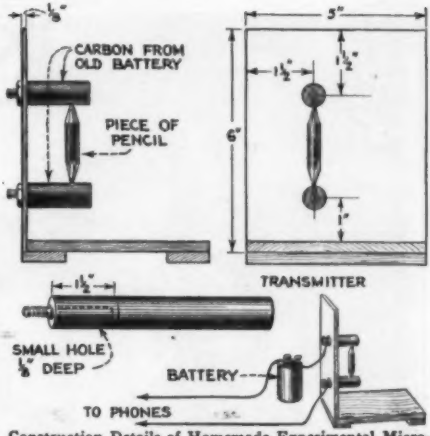
New Rectifier for A-Eliminator



A new dry-plate rectifier for A-eliminators of the type shown in the illustration has recently appeared on the market. It replaces the dry unit originally supplied with the A-power device and is said to give longer life and quieter operation. Being inclosed in a perforated metal case, it may be fastened to the eliminator in the manner shown. Two connections are all that are necessary to install it.

An Experimental Microphone

The microphone for the beginner, shown in detail in the illustration, is a homemade device that requires but one dry cell for its operation. When connected to the battery and headphones or a radio amplifier,

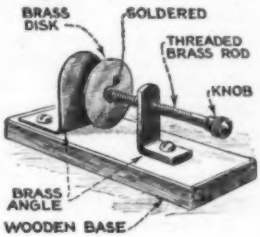


Construction Details of Homemade Experimental Microphone; Below, Completed Unit Showing Connections

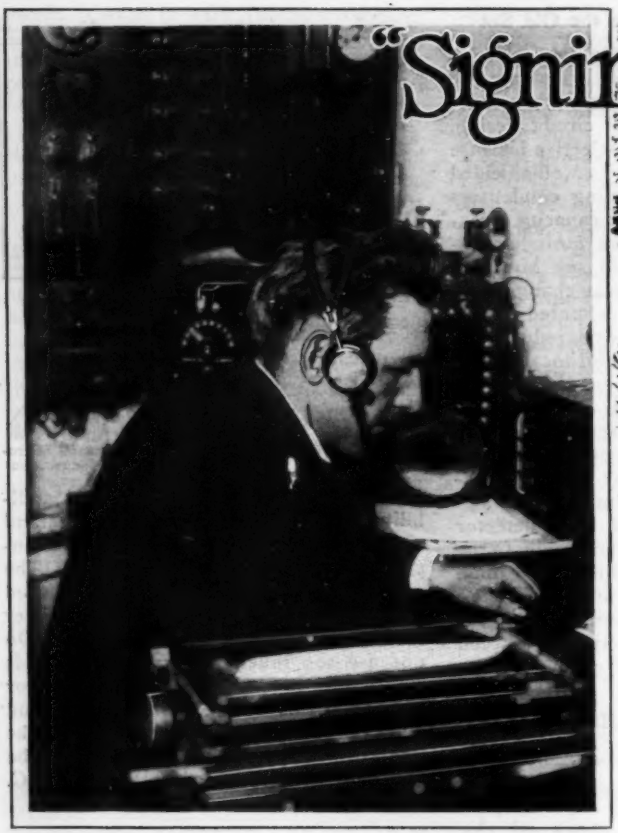
it will transmit speech with good audibility. The person speaking should stand about 1 ft. away from the "mike." The construction requires little comment. The pencil, sharpened at both ends, is placed loosely in the holes in the upper and lower carbons so that it will move freely. Do not use too much battery; 1½ volts is sufficient for good results. The author has found this device very sensitive, and many interesting experiments can be worked out with it. The carbon may be obtained from discarded batteries.—A. C. Alderton, Wanganui, New Zealand.

Homemade Aerial-Coupling Condenser

In trying out several short-wave hook-ups, I noticed that the commercial antenna-coupling condensers are not easily adjusted for maximum effect. The sketch shows a simple homemade type that works satisfactorily, as it provides a means of very fine adjustment. The sketch is self-explanatory. Small variable condensers of this type are useful for neutralizing or balancing, and the experimenter will find it convenient to have several on hand.—A. B. Robbins, Muscatine, Ia.



"Signing Off"—



Arthur Jensen, Radio Operator of the S. S. "American Shipper," Telling the World the "Vestris" Survivors Had Been Rescued

WHILE science is constantly devising means of securing safety on land and sea and in the air, in the final analysis it remains for mankind to furnish the heroes.

Radio, or wireless, as it was called in the days when the world first thrilled at its efficacy and felt more secure because of its existence, provides a way, but it still takes men to do the deeds.

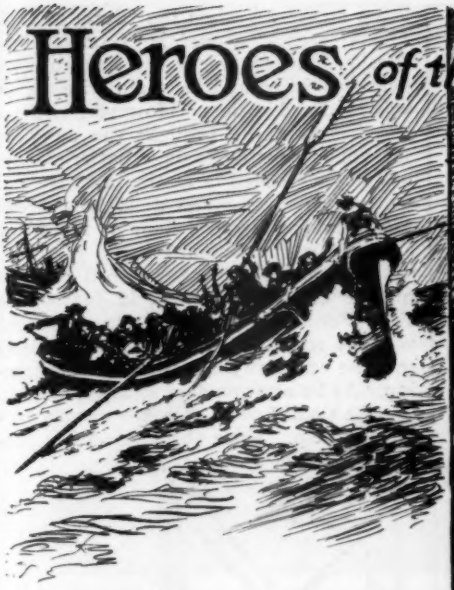
Michael J. O'Loughlin, the newest name on the permanent roll decorating the fountain of honor in front of the barge-office tower, down at the Battery in New York, received the same kind of commendation that was given comrades in the service who have thought of others before they have thought of themselves.

A federal radio official said of this man, who was lost on the tragic voyage to South America, that the "operator of the 'Vestris' handled his end of the distress traffic in a commendable manner from the time this observer first heard his signals to the last transmission on failing power a few minutes before the last signals on his emergency set were sent, notifying all stations the ship was being abandoned."

There are twenty-three additional stories, each with its own scenery and characters and all with the same plot, which tell of the cruelty of the sea and the self-sacrifice of men whose minds responded so brilliantly in emergency, and whose generosity was so great that their lives were their gifts.

No matter whether the ship foundered on a reef, collided disastrously in fog or was a victim of fire or storm, each of the wireless operators who died at their posts, did the same thing—gave his life for others. Then there are those who have shown forgetfulness of self in relinquish-

Heroes of the "SOS"



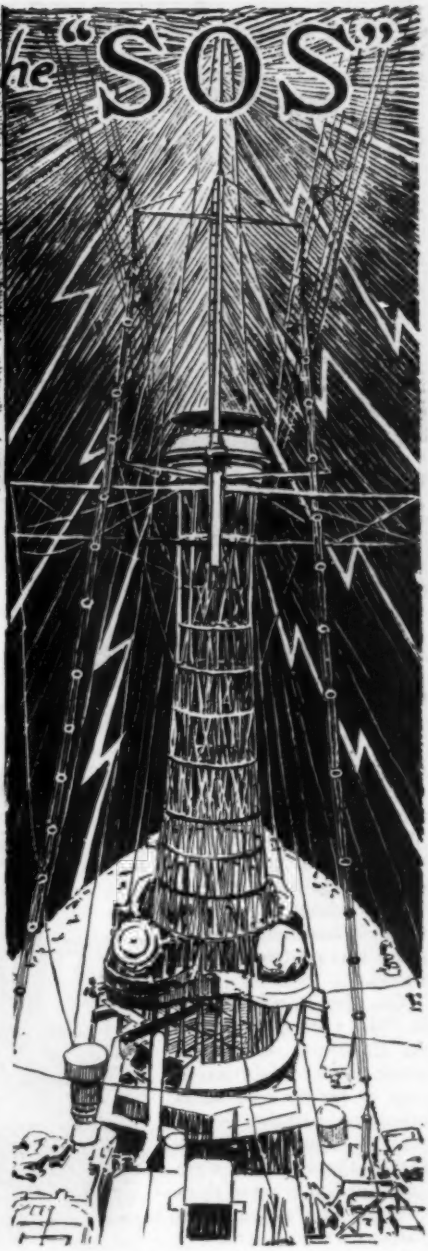
ing places in lifeboats or giving up means of remaining afloat.

One youth rushed from his bed, pajama-clad, and in the three minutes before the ship sank, adjusted the auxiliary wireless set and succeeded in getting a call through. When both dynamo and storage batteries had been submerged by the sea, another operator and his chief succeeded in making the set function temporarily.

After performing fast work with the key, the wireless man of an Atlantic vessel gave up his life belt to a passenger. Out on the Pacific coast, another relinquished his hold on driftwood in order that it might support a woman.

The memorial which bears the stories of sea dramas was dedicated in 1912, after Jack Philips, the wireless operator of the "Titanic," had inspired the world to create a memorial to marine messengers. Under the inscription, "In memory of wireless operators lost at sea at the post of duty," appears first the name of George Eccles.

He was instrumental in saving 200 persons when his ship, the "Ohio," went on an Alaskan reef nearly twenty years ago. In the thirty minutes left to the "Ohio," he raised an Alaskan station which signaled two near-by vessels. In 1910, Stephen Szepanek flashed the call for help



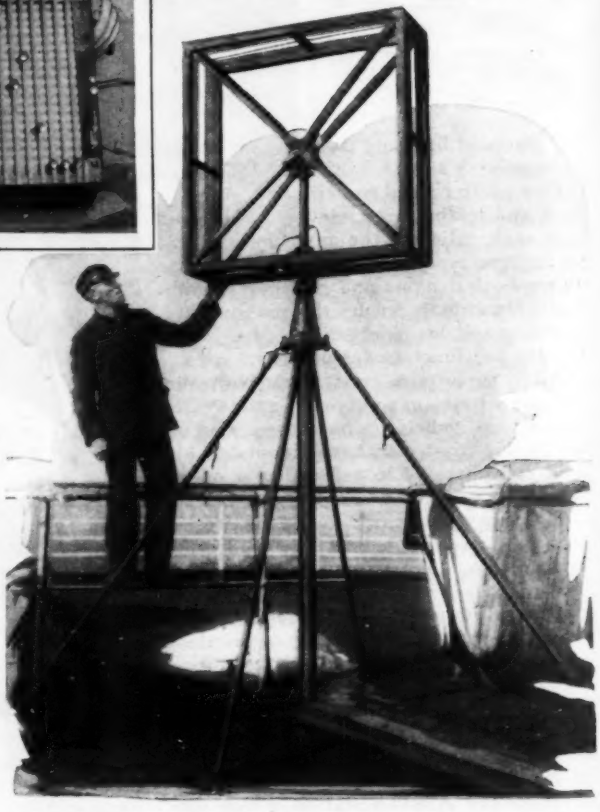
Cage-Type Aerials Swing in Festoons from the Basket Masts of Battleships; This Is a View from the Masthead of the "New Mexico"

when the railroad-car ferry which plied the Great Lakes sank as it approached Milwaukee. Whether a submerged rock or shifting loaded cars caused the plunge of the ferryboat is not certain. When help arrived, there was no trace of the vessel.

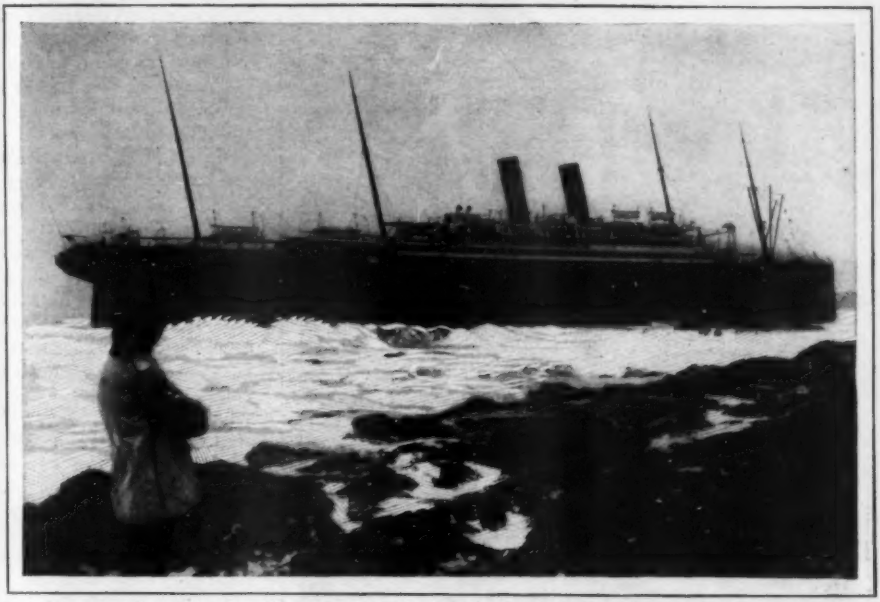
On the Pacific ocean, in 1913, young Lawrence A. Prudhunt refused a place in the lifeboats to stay at his task of summoning aid to the "Rosecrans." Due to his efforts, three men were saved of the crew of thirty-six. There were no passengers on board.

It was Donald Campbell Perkins who worked so desperately fast after being awakened when the "State of California" struck a reef in Gambier bay, Alaska. As so frequently happens, the dynamos failed and his main wireless set was rendered useless. However, in those three minutes he brought the auxiliary set, which runs on storage batteries, into use and succeeded in getting aid. He was made a prisoner when a lifeboat broke loose and jammed the door of the cabin, and sank with the ship.

When the "Monroe" was in a collision off the coast of Virginia, in January of 1914, Ferdinand J. Kuehn stayed in the wireless room flashing out calls for help until he was sure that assistance was coming. As he went on deck to assist in loading the small boats, he met a woman crying for help. Since she had no life pre-



Lieut. Pedro C. Andres, of the Cuban Navy, with an Automatic SOS Sender of His Own Invention, Top, and the Directional Loop of the "Leviathan"



A Lone Sentinel Standing Guard over the "Celtic," After the Big Liner Ran Aground on the Rocks, While Entering Queenstown Harbor, Ireland, without a Pilot in a Dense Fog

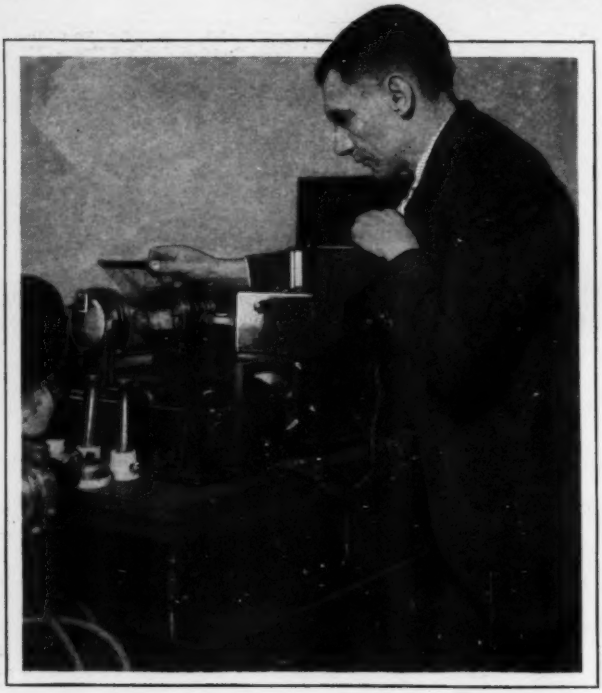
server, he gave her his own and helped her into a lifeboat. There, by the davits, his foot slipped and he fell into the water, never to be seen again.

In April of that year, Walter E. Reker displayed his resourcefulness and bravery in a collision when the "Admiral Sampson" and the "Princess Victoria" crashed in Puget Sound. The "Princess Victoria" stood by so close to the sinking vessel that passengers could climb from one to the other until damaged oil tanks caused the "Admiral Sampson" to catch fire. Although the operator of the slightly injured vessel wirelessed that he would send for help, Chief Operator Reker stayed at his post until his calls were through. Afterward he assisted passengers to the lifeboats. When the last load had left, he reported to the captain on the bridge and went down with the ship.

A man of only seventeen years offered his life for others and gave it for one woman when the "Francis H. Leggett" foundered on the Duxberry reef off the west coast, in September, 1914. Clifton J. Fleming went down with the ship after staying at his post. Coming up in the pounding sea, he grasped a piece of wreckage for support. When he discovered a woman struggling in the water, he assisted her to the drifting wood and relinquished his hold upon it, since it would not support both. His assistant, Harry Fred Otto, had stayed with him in the wireless cabin sending out calls, until the Pacific closed over the little room. He was not seen again.

It was Adolph J. Svenson who, with his chief Loren A. Lovejoy, rigged up an auxiliary set as soon as the water ran off the storage batteries at another lurch of the sinking "Hanalei." When the wireless cabin was swept overboard, he assisted the chief in sending signals to the nearby Pacific shore with a flashlight. In spite of the fact that men on land could see the signals, it was almost impossible, due to the storm and terrain, for them to effect a rescue. When only wreckage remained of the "Hanalei," Loren Lovejoy was picked up from the piece of driftwood to which he was clinging by a passing ship. Adolph Svenson was added to that band who died on duty.

There follows a period of years when war added hazards to the seas. Mines, submarines and the danger of collision



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Navy Radio Operator Broadcasting Weather Maps to Ships at Sea; This System Is One of the Most Important Advances in Navigation

from running with few lights were new perils to augment wind, fog, fire and uncharted reef.

George Arundel Gear gave his life during those troublesome days. His ship was the "Manga Reva." His message, "Come as quickly as possible; am drifting before the wind with no boats," was sent off the coast of France. Neither he nor his captain had the comfort of knowing that other ships were racing to the rescue, for his last call reported, "No responses to calls for assistance. Going fast."

During the war, when armed naval guards were aboard merchant steamers, the tanker "Motano" was torpedoed by a submarine. Sinking within a minute's time, Russell A. Williams, the wireless operator, was among those to lose their lives.

Another disaster in which the ship sank so rapidly that very little rescue work could be done, was that off the Atlantic coast, on May 1, 1918, when, during a dense fog, a French warship rammed the "City of Athens," a steamer in the coastwise trade. Francis Joseph Doherty, the wireless operator, went down with the ship.

Emile H. Hulsemann's last message was heard on Feb. 29, 1920. It is believed that the wireless of the "Cubadist" was torn away in the gales that characterized that season off Cape Hatteras and which took toll of this ship among the coastal traffic.

When the "Macona" struck a rock off the Nidigen light on the Swedish coast, Lawrence B. Robinson, wireless operator, lost his life. Only one of the crew of fifty was saved.

Evidences of fire on the drifting wreckage, marked with the name of another ship to join the mysteriously sunk, the "Swiftstar," gave evidence that Ernest E. Dorsey was given no second to flash SOS. Mariners believe that this tanker was struck by lightning.

Two days after Christmas, 1923, within an hour after he had signaled that the number-one hold of the "Conejos" was filling with water, Fred Salim sent a last SOS reporting that the ship was sinking fast and giving its position in the Black Sea. Although its sister ship, the "Clontarf," and other vessels rushed to the aid of the distressed boat, no traces of it were found.

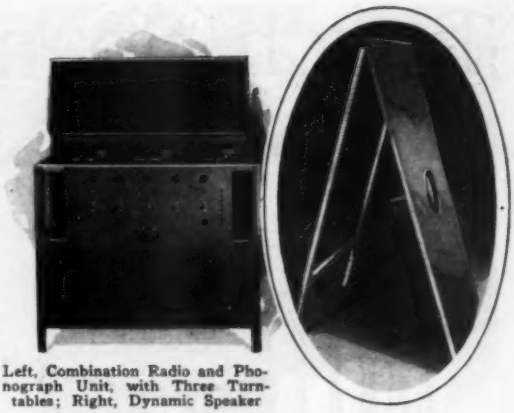
When the "Haleakala" was twenty-five days overdue, it was decided that it had been lost in the hurricanes which were sweeping the Atlantic coast. Peter L. Bacuinka was the radio officer who went down with this ship. About 200 miles west of the Philippines the freighter "Elkton" went down after the wireless operator, Charles F. Ruble, had flashed that it was disabled.

A smear of oil spreading for five miles was the only trace found of the "David

C. Reid" when rescue ships arrived. They had plowed through a storm area off the Azores after they received messages calling for help in October of last year. Maurice Black first radioed, "We are in a bad way. Come over." "We are going fast," was the cry seven minutes later.

There are three other men who were licensed to handle ships' wireless and who were lost at sea at their post of duty. Boris Michael Dutko was on the "Brindilla," which was lost in December of 1919. James J. Curran's ship, the "Moreno," went down in June, 1917, off the Azores. Lawrence M. Waring, Jr., lost his life on the "Cotopaxi," which foundered off the Florida coast in December, 1926.

At the dedication of the memorial, Commissioner H. Cabot Ward linked science and men and deeds in saying: "It is a wonderful quality of the human soul that new conditions always bring new manifestations of heroism."



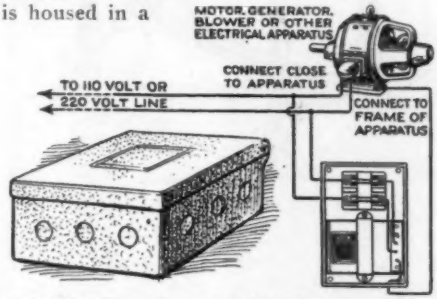
Left, Combination Radio and Phonograph Unit, with Three Turntables; Right, Dynamic Speaker

Radio and Phonograph Amplifier

A simplified arrangement of phonograph pick-up unit and power amplifier combined with a radio set is illustrated herewith. This device is now available for small motion-picture theaters or other public places where loud volume and continuous programs are required. Three phonograph turntables are arranged to permit interchange of records without interruption. The dynamic speaker supplied with the combination unit is mounted on a large baffleboard which is supported in easel fashion.

Device Stops Man-Made Static

The filter shown in the sketch is a new development in the radio field along the line of devices designed to eliminate man-made static at the source. The manufacturer maintains a special service to help those who are confronted with such interference, which is a real problem for radio listeners. It is claimed to take out static caused by motors, blowers, fans, sign flashers, ice machines or any electrical device using 110 or 220 volts regardless of horsepower. The connections are simple, and the unit is housed in a metal container with holes for easier installation.


MOTOR, GENERATOR, BLOWER OR OTHER ELECTRICAL APPARATUS
CONNECT CLOSE TO APPARATUS
TO 110 VOLT OR 220 VOLT LINE
CONNECT TO FRAME OF APPARATUS

Left, Filter Device Inclosed in Metal Container; Right, Diagram of Connections

¶Popular Mechanics radio department offers its services free to all readers. We will be glad to help you with your problems and will promptly answer all inquiries.

A. C. Tube-Operating Hint

A.c. tubes, such as the CX-326 and C-327, and particularly the latter, operate at comparatively low voltages and high current; the CX-326 at 1.5 volts and 1.05 amp., and the C-327 at 2.5 volts and 1.75 amp. Unless a socket whose spring terminals make very good contact with the tube prongs is used, the contact resistance between the tube prong and the socket terminal may be sufficient to reduce current supply to the C-327 to a value that is too low for satisfactory operation.

Bench for Spanish Radio Cabinet

THE BENCH described here is designed to harmonize with the Spanish radio cabinet illustrated in the October and November, 1928, issues of Popular Mechanics, but it is a handsome piece of furniture, and well worth building for its own sake. The construction is simple and the upholstering is easily done.

Either hard or soft wood may be used for the frame of the seat, and the construction is so well shown in the illustrations that no details are necessary. The four legs are turned from 2 by 2-in. rough walnut, which, if accurately centered on the lathe, will easily give the largest required diameter of 1¾ in. See Fig. 4. A little time in turning is saved if two legs are turned from the same stick. Use rough walnut stock, 1 by 2-in., for the stretcher, which is detailed in Fig. 6. If the legs of the radio cabinet were made of flat stock, the legs of the bench should be made to correspond, and Fig. 8 details this construction. Cut four pieces of 1 by 6-in. rough walnut for the legs, smoothing two sides of each. Blanks for the two rails are made from stock 3 in. wide by 10 in. long.

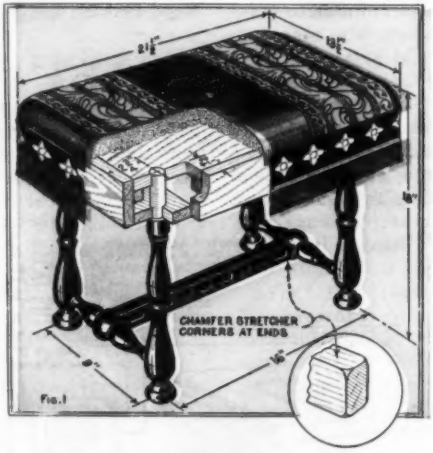


Fig. 1

Glue the rounds to the stretcher, then add the legs and slip the seat on. Reinforce the upper ends of the legs by nailing through the seat. If the work has been well done, the assembly should be square, and the stool should stand with very little tendency to rock. Before adding the upholstery, fill the stretcher and legs, then varnish or wax the walnut to correspond to the finish given the radio cabinet.

Unroll cotton batting on the seat, lapping it back and forth until the pile, when compressed, is 1¼ in. thick, stepping back the ends of the upper plies to give the curve to the edges. Allow the cotton to project a little beyond the sides and ends, so that the rail edges will not

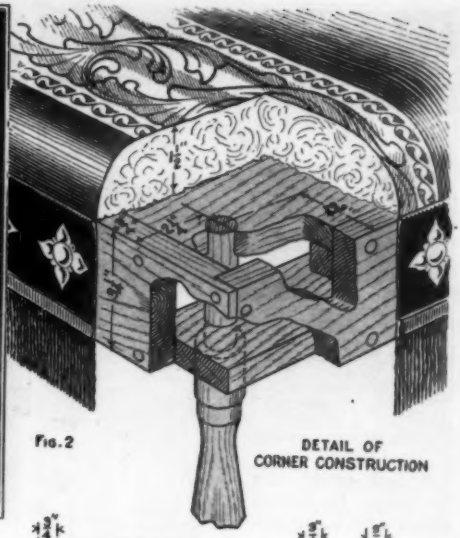
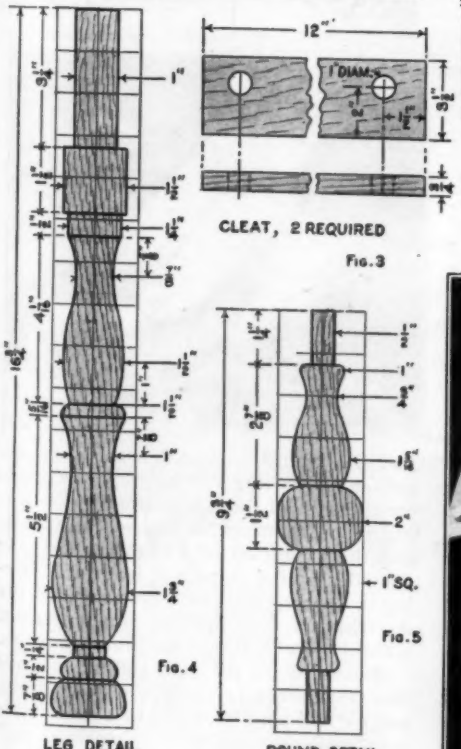


Fig. 2

DETAIL OF CORNER CONSTRUCTION

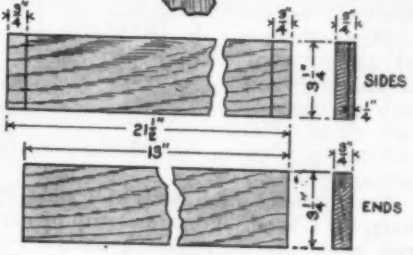


LEG DETAIL 4 REQUIRED

Fig. 4

CLEAT, 2 REQUIRED

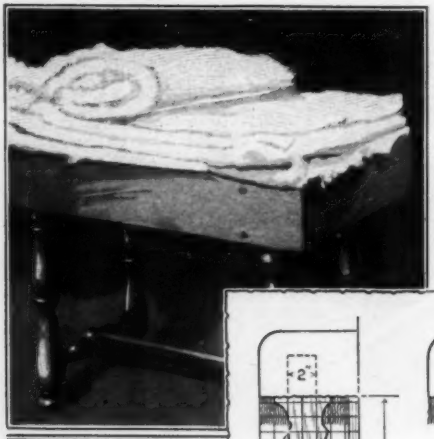
Fig. 3



RAIL DETAILS

ROUND DETAIL 2 REQUIRED

Fig. 5



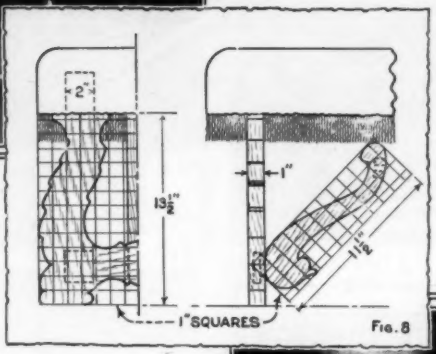


FIG. 8

jut out when the covering is drawn tight. Cover the stuffing with a piece of stout cloth, tacked in the centers of the sides and ends. Finish tacking by working toward the corners, and apply the tapestry.

Cut a strip of plush, 4 in. wide and 6 ft. long, for a band. Prepare a strip of narrow strap iron by punching holes every inch. Nail this around the top edge of the seat frame to hold the upper edge of the plush, pile inward. Sew the corner of the band and pull the plush down over the iron until it is tight. Tack the lower edge under the rails. Sew the metal fringe to the band.

The seat illustrated was covered with brown brocade having gilt flower designs and stripes in light blue and old rose edged with black and yellow. This same material was also used for the radio grill. For the band, a dark vermilion bordering on maroon was chosen, and this was used as backing for the radio-cabinet plaques.

The ornamental nail heads, shown in Fig. 7, are laid out on 1¼-in. circles. Make a full-sized tracing with which to transfer the design to 21-gauge sheet brass. With tin snips cut the designs into individual squares, and cut the outlines with a jewelers' saw. Prick-punch the centers, scribe the center circles, and outline them with a narrow chisel made by hammering and filing a round-nosed flat point on a spike. Use a hardwood block when outlining. Then lay the ornaments, upside down, on a soft-wood block and hammer up the centers and petals, using the round end of a glass-cutter handle, the ball of a hinge pin or any other available tool. "Antique" by heating in a flame, punch the centers for round-head brass escutcheon nails, and nail them to the stool rails, as indicated, spacing them evenly with dividers.

The corner clasps are four in number, being designed as an overlapping pair of nail heads.

The photos accompanying the drawings show the following operations: page 655, nailing the seat frame together and boring the holes in the cleats for the ends of the legs; page 656, the laying of the batting for the seat covering, and the paring off of a round to take the shoulder of the stretcher; page 657, boring a leg for a round, marking for the stretcher flat on a round, hammering out a nail head and two of the finished heads.

If you cannot get good walnut to make this stool, write to the Radio department, and we will tell you where to obtain it. Do not "spoil the ship for a ha'p'orth o' tar" by using soft wood.

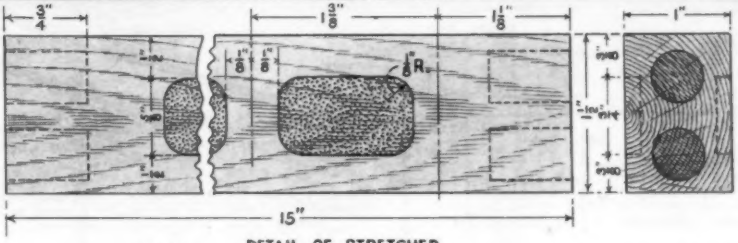
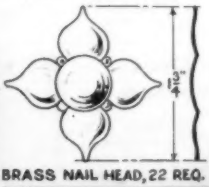


Fig. 6 DETAIL OF STRETCHER



BRASS NAIL HEAD, 22 REQ.

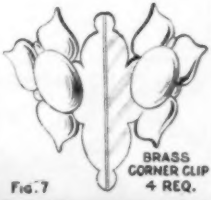
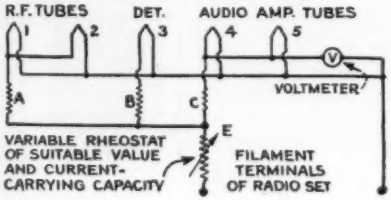


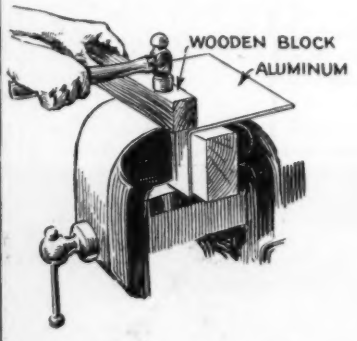
Fig. 7 BRASS CORNER CLIP 4 REQ.

Helpful Radio

To Prolong Their Life, Connect Tubes of Like Characteristics in Groups on Variable Strip-Type Resistors, as Shown Below (Left) at A, B and C; Adjustment for Decreasing Voltage Is Then Made with Master Rheostat E; with Most of Resistance of E in Circuit, Vary A, B and C Until Voltmeter Placed across Filaments Shows Correct Voltage. Then Solder Clips in Position; Permanently Connect Voltmeter; E Now Varies Voltage Applied to All Tubes in Correct Proportion

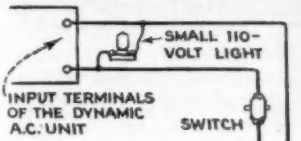


Above, a Short Piece of Rubber Tubing Insulates Soldered Joint; the Wire Should Be Twisted to Insure a Good Mechanical Connection



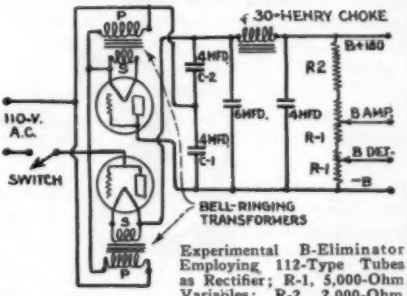
Bending Aluminum Sheet for Homemade Shield Boxes Is Not Difficult, if Done as Shown Above; Right, Lead-In and Power Supply from Double-Outlet Wall Plate; Antenna and Ground Connections Are Made to One Plug and the 110-Volt Supply Connection to Another

Hints *from* Experts

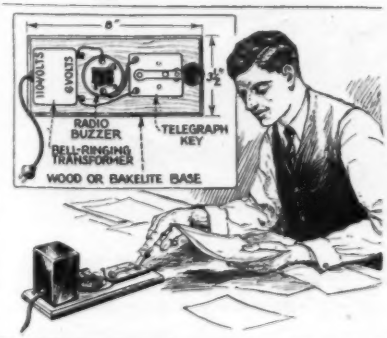


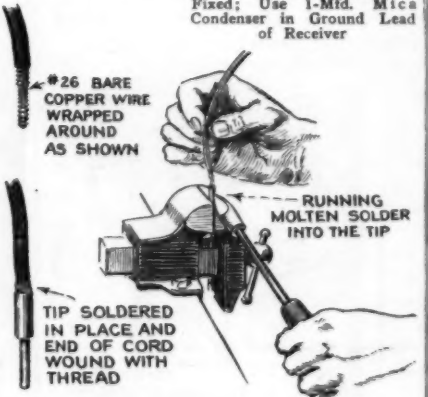
Mounting an Indicating Lamp for A.C.-Operated Dynamic Speaker as a Reminder to Turn Off Current; a Hole Is Bored in Front of Speaker Cabinet and Light Mounted behind a Jeweled Port and Connected in Supply Line as Shown

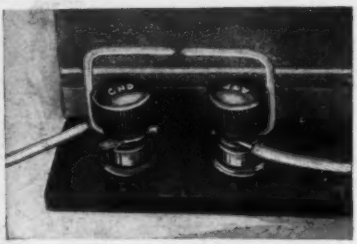
An Excellent Ground Connection Made from 5 Ft. of Brass Pipe, Threaded for an Old Brass Well Point and Ground-Wire Connection; When Ground Wire Is Connected Cover Top Connection with Waterproof Paint; Below, Code-Practice Set Operated from 110-Volt House-Lighting Supply Gives a Steady Signal Which Does Not Change Pitch; Lower Right, Soldering Tip on Broken Tinsel Phone Cord Is Not Difficult, if the End of the Lead to Be Soldered Is First Wound with Bare Wire



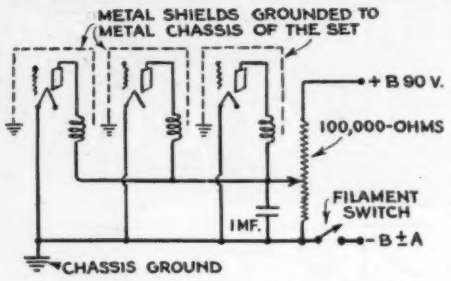
Experimental B-Eliminator Employing 112-Type Tubes as Rectifier; R-1, 5,000-Ohm Variables; R-2, 2,000-Ohm Fixed; Use 1-Mfd. Mica Condenser in Ground Lead of Receiver



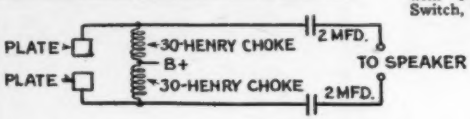

#26 BARE COPPER WIRE WRAPPED AROUND AS SHOWN
RUNNING MOLTEN SOLDER INTO THE TIP
TIP SOLDERED IN PLACE AND END OF CORD WOUND WITH THREAD



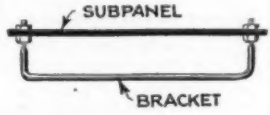
Small Gap, Arranged between Antenna and Ground Posts with Pointed Wires as Shown, Protects Set during Electrical Storms

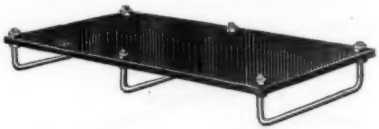


Oscillation Control for Tuned R.F. Sets, Obtained with 3-Tap Variable Resistor; Note Filament Switch, When Turned Off, Cuts Resistance Out of B-Circuit

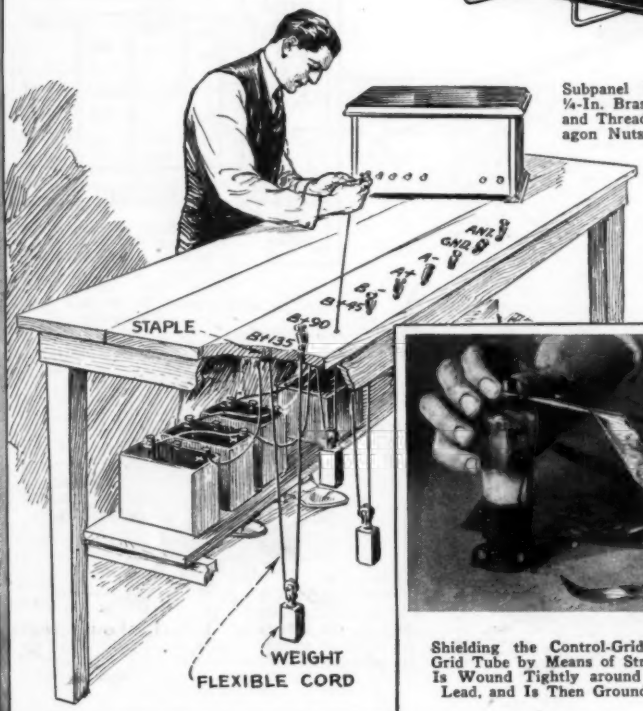


Double Filter Arrangement, Used in Push-Pull between Power Tubes and Speaker, Claimed to Give Good Response at All Frequencies Instead of Cutting Off at Certain Frequencies as in the Case of Many Output Transformers





Subpanel Brackets Made from ¼-In. Brass Rod, Bent to Shape and Threaded at the Ends; Hexagon Nuts Hold Panel in Place



Left, Handy Battery-Cord Arrangement for Test Table Makes Quick Connections Easy; the Counterweights Keep the Leads Out of the Way When Not Required

Shielding the Control-Grid Lead of the Screen-Grid Tube by Means of Strips of Tinfoil; the Foil Is Wound Tightly around the Insulation on the Lead, and Is Then Grounded to the Stage Shield

Curing Noise in Set

The writer has a set that has been performing satisfactorily until recently, when, if anyone walked across the floor, heavy static noises issued from the speaker. Supposing it to be a loose connection, I cleaned the battery terminals, examined the tube and socket connections and renewed the speaker cord, but without improvement. I put in new tubes and batteries; still no improvement. After several weeks of this interference, I found the ground clamp on the water pipe in the basement badly corroded and very loose. This pipe being directly beneath the floor of the room in which the set was located was jarred by anyone walking above. A new ground clamp remedied the trouble. The moral is: When things go wrong with the set, start hunting for trouble at the largest connections, for without good aerial and ground contacts, it is useless to tinker with the set. —Ralph LeCompte, Herbertsville, N. J.

Grounding of Transformer Cases Eliminates Hum

One of the most troublesome sources of hum is that due to external fields around the power transformers used in the power pack. This trouble may be eliminated by connecting the metal cases or cores of the transformers to either the ground lead or the B-negative lead of the receiver or power pack, so as to bring the cases and cores of all transformers to the low-potential side of the circuit. This also applies to the a.f. transformers, if they are not already grounded to a metal subpanel.

Left, New Tube Checker Showing Plug for A.C. Line; Right, Checker in Operation with Tube Inserted

Tube Checker Operates from A.C. Line

The new tube checker shown in the illustration operates directly from the regular a.c. 60-cycle lighting circuit and is so designed that the circuit may have any voltage from 90 to 130 volts. It will check all tubes, a.c. or d.c., using filament current of 1.5, 2.5, 3.3, 5 or 7.5 volts, including rectifier tubes. The checker is equipped with sockets for UX, UY and UV-tubes; a line-voltage adjusting dial; a five-point filament-voltage dial, push buttons and suitable meters. An instruction card is supplied.

¶Dry cells may be tested with an ammeter having a scale of 25 or 30 amp.; the instrument should be held on the cell just long enough to get a reading, and cells showing less than 10 amp. should be discarded. A voltmeter may also be used; a good dry cell should register 1.4 volts and should be discarded when the reading falls to 1.1 volts.

FOR THE RADIO BUILDER

The simplified blueprints listed below include the best of Popular Mechanics tested circuits. When ordering, simply quote the numbers of the blueprints desired and inclose the proper amount in an envelope addressed to Popular Mechanics Magazine, Radio Dept., 200 E. Ontario St., Chicago, Ill. Back magazines containing full descriptions of the circuits can also be obtained. Inclose an additional 25 cents for each magazine desired, giving date of publication.

No. 111, Homemade Tube Tester	July 1926	25c
No. 115, 15 to 550-Meter Three-Tube Receiver	Nov. 1926	25c
No. 116, Three-Tube Loop Set	Dec. 1926	25c
No. 117, Simple Electrolytic B-Eliminator	Feb. 1927	25c
No. 123, Economy-Nine Superheterodyne	Nov. 1927	50c
No. 126, Homemade B-Battery and Charger	Jan. 1928	25c
No. 130, One-Tube Short-Wave Adapter	Mar. 1928	25c
No. 131, Five-Tube All-Electric Receiver	Apr. 1928	25c
No. 134, Edison Type B-Battery	July 1928	25c
No. 135, Screen-Grid Browning-Drake Receiver	Sept. 1928	25c
No. 138, Screen-Grid Perfect-Tone Six Receiver	Nov. 1928	25c
No. 139, Simple Television Receiver	Dec. 1928	25c
No. 140, Power Amplifier and B-Supply for Television	Jan. 1929	25c
No. 141, Hammarlund-Roberts Hi-Q 29 Junior A.C. Receiver	Feb. 1929	25c
No. 142, Two-Tube Screen-Grid Short-Wave Adapter	Mar. 1929	25c

Complete Kit for Service Men

A complete testing and repair kit for the busy radio-service man is shown in

New Radio Kit Showing the Complete Equipment Required for Testing and Service

the illustration, nothing having been overlooked that is necessary to meet any emergency. Safety devices protect all meters and circuits so that an error in testing will not damage the instrument or the set itself. It can be lifted out of the carrying case for store or laboratory use. Various fixed condensers, from .001 to 2 mfd., a 30-ohm rheostat, a 500,000-ohm variable resistance, and an audio transformer are available for instant use and in various combinations. The kit is equipped with standard meters and makes accurate tests of voltage and current of all radio receivers, including those using the newest tubes.

Removing Hum from Dynamic Speakers

First determine whether or not the hum is caused by the dynamic speaker, as it may be in the set instead. When located in the speaker, there are several simple methods of reducing and often eliminating the hum. One simple method of testing the speaker for hum is to remove the output tube of the set, when, if the hum continues, it is evidently in the speaker. Dynamic speakers are of three varieties, one in which the field is energized by direct current from a storage battery; another in which the field is energized by means of rectified 110-volt current, or 110-volt direct current, and a third in which the field is energized by means of current from the B-eliminator. The battery-operated type cannot cause a hum. The second type is the one in widest use and most likely to cause the trouble. The third type seldom gives trouble and when it does, the remedy is usually beyond the average set owner. As regards the second type, simply shunting high-capacity condensers across the field coils will frequently eliminate the hum. These condensers should be of the heavy-duty type from 4 to 8 mfd., the capacity varying with the type of speaker used. In some cases, A-type condensers of large capacity are required across both field coils. In extreme cases, a high current-carrying choke of the type used in A-eliminators, placed in series with the rectifier and field coils in addition to the A-type condensers, will be required.

World Time for DX-Radio

The radio clock shown in the illustration is now available for DX-listeners who wish to follow the programs not only from their local stations, but of all the stations their receiving set will reach. As seen from the illustration, there is a secondary dial listing the principal time-zone localities, namely, Eastern, Central, Mountain, Pacific, Alaska, Hawaii, Berlin, London, Canary Islands, Azores, Rio de Janeiro and Atlantic, thus completing the time circle. The secondary dial may be turned so as to be set for use anywhere. With this arrangement one can determine local time in any part of the world.

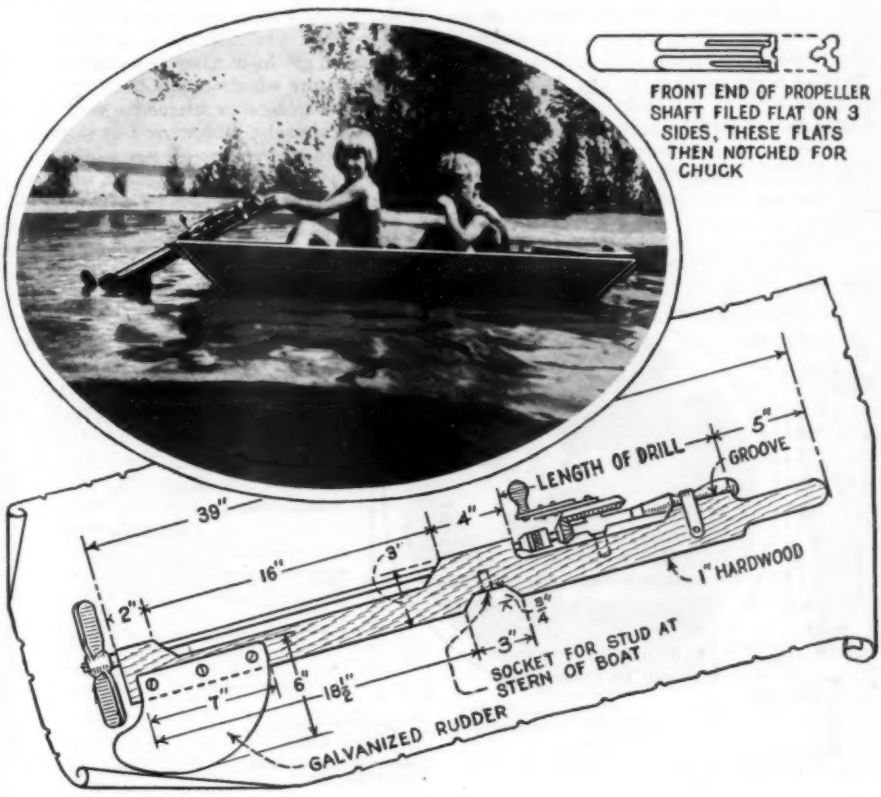
¶When testing B-eliminators for maximum output with a low-reading milliammeter, the meter should be protected against burn-out by a fixed resistance of 1,000 ohms or more placed in series with the meter.

AMATEUR MECHANICS

"Outboard Motor" Pleases Youngsters

By HI SIBLEY

ROWING a boat has always seemed a clumsy and laborious means of getting over the water. Maneuvering in close quarters and on small ponds is awkward with oars. It's tough on unaccustomed backs in a pull against the wind, and your boat loses momentum between each stroke. Turning a crank is much easier, as with this manual outboard motor. Perhaps one cannot go quite as fast with this device as with oars, but the push ahead is continuous, and a youngster with imagination will get a real thrill from seeing the water churning up behind; besides, he



can reverse it instantly as in a motorboat.

If you own a hand drill, the job is half done. The drill constitutes your motor, and this outboard is so designed that the drill can quickly be taken out and used for its original purpose at any time. The only alteration—and even this is not absolutely necessary—is extending the crank handle to give greater leverage. In the one illustrated we simply built up an extension from three sections of perforated bar borrowed from a toy-construction set. A flat iron bar will serve even better in case you can drill the holes for the bolts and handle.

The framework should be made from a piece of wood, 39 in. long, 1 in. thick and 3 or 3½ in. wide. Select some tough wood not likely to break or split. Yellow pine will do.

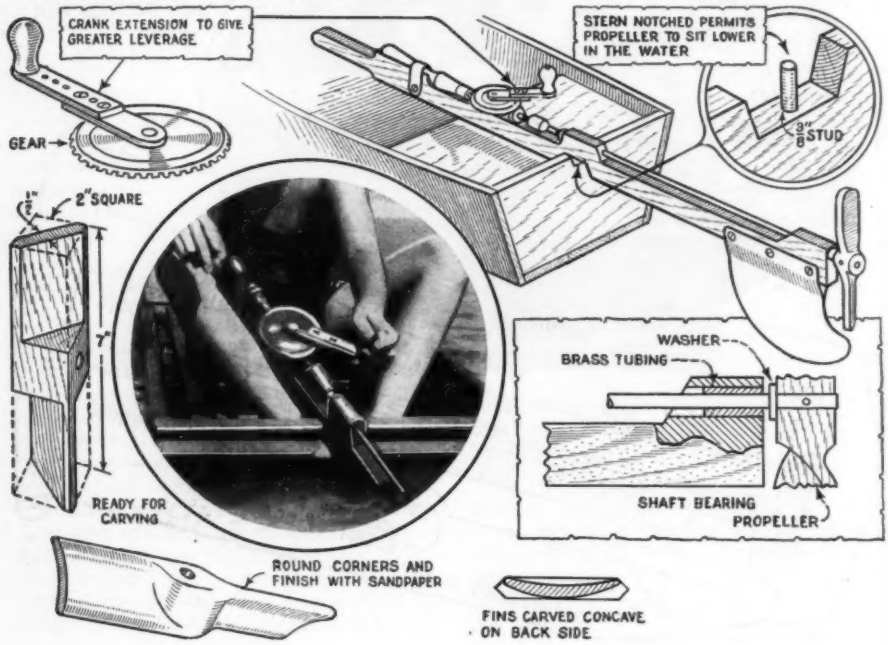
Saw out as shown in the diagram, and bore the two holes for the propeller-shaft bearings. These bearings, which are sections of brass tube, should be driven in to a snug fit. After being in the water a short time, the wood will swell and hold them securely in place. They do not need to be as long as the holes in the wood.

For the propeller shaft, we used a brass curtain rod, ¼ in. in diameter, since it happened to be the only thing on hand at the time. However, a cold-rolled steel rod, 5/16 or ⅜ in. in diameter, is recommended, depending upon the size of your drill chuck. The cheapest hand drill, by the way, will suffice for a light-duty motor, its only disadvantages being the noisy gears and unreliability of the chuck, as well as its inability to stand a heavy load. A big sturdy drill will be much better if you care to make the investment.

Cut the propeller shaft to 25½ in., then flatten the forward end on three sides with a file for a length of about 1 in. In the center of each flat place, file a groove, about 1/16 in. deep, running lengthwise. These grooves are to give the three chuck jaws a better grip.

The propeller is much more easily made than might be expected. Use a piece of close-grained wood, 2 by 2 in. in section by 7 in. long. Saw out as indicated by the dotted lines and bore the hole for the propeller shaft. Have this a snug fit, but not too tight, or, in forcing the shaft in, you may split the wood.

With a gouge or curved chisel, make one side of each fin concave and the other,



or forward side, convex. When finished, the fins or blades should be about ¼ in. thick. Whittle the edges all around to about ⅛ in. thickness, then round them with sandpaper. With a sharp jackknife, round the hub so there will be no sharp corners or edges, and thus make it smooth and streamlined. Insert the propeller shaft so that the end is flush with the backside of hub. Now carefully drill about a 3/32-in. hole through hub and shaft and insert a nail or steel pin.

Take pains with your painting. If convenient, apply a coat of filler to the propeller and sandpaper smoothly when dry. Two coats of bright red give a lively touch, and they should be followed with two coats of spar varnish. Let each coat dry and sandpaper well after all but the final coat.

Now you are ready to fit the hand drill to the frame. It will be simple if you have the type of drill used by the writer. In this a stud opposite the center of the main gear is set in a hole in the wood frame, and the handle is clamped to a grooved section by means of a brass strap.

If you have selected a nicely grained wood for the frame, leave it in the natural finish, covering with two or more coats of spar varnish.

Cut the rudder, as shown, from a piece of galvanized sheet, as heavy gauge as your snips will handle. Paint the rudder well with bright red, same as the propeller, or a bright green. Give it two coats of spar varnish also, and, when dry, attach to the frame with screws.

The final assembly consists simply in inserting the propeller shaft in the bearings and tightening the chuck jaws over it. If your propeller blades are tilted in the right direction, as shown, the rotation tends to keep the chuck tight, so that after a few revolutions you can reverse under load without fear of loosening the chuck jaws.

We found that by notching the stern board of the boy's little boat, the propeller would sit lower in the water and at the same time be in a more convenient position for the operator. This, however, will not be practicable if the boat at your disposal is a rented or borrowed one.

You will find the making of this little outboard an absorbing pastime during the spring evenings, and you will then be ready for a cruise as soon as navigation opens. It can be conveniently carried anywhere, and the efficiency of this sturdy little power plant is limited only by the muscles of your arm.

Cover for Auto-Tire Padlock

Mud, which gets inside of the padlock used by many car owners on their spare tire, causes considerable difficulty in opening the lock when the tire is needed. To prevent this, a cover should be provided for the lock. It can be made from a piece of thin leather, cut and folded and then sewed up the sides as shown. A coil spring is slipped over the open end, which is then turned back over the spring and the edge sewed down, imbedding the spring in a hem. The bag is made to fit snugly over the padlock and, when finished, it is turned inside out so that all seams will be hidden. The spring holds the bag on the lock securely and prevents mud and water from getting into it.—F. J. Wilhelm, Cincinnati, Ohio.

Cardboard Device Used by Photographer for Finding Best Viewpoint

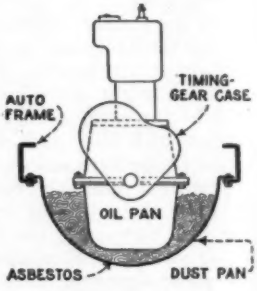
Finder for Photographs

I have found the illustrated device useful in selecting a viewpoint for any particular landscape or object to be photographed. A card is cut to the same size as the plate or film used in the camera, and a rectangular hole, about two-thirds the size of the card, is cut out with a sharp knife or razor blade. At the inside edge of the opening thus formed a small cord is attached as indicated, and a number of knots are tied at intervals on this cord, the distance from the edge of the hole to the knots being equal to two-thirds of the focal lengths of the various lenses used on the camera. The landscape or object to be photographed is viewed through the opening of the card and the distance of the eye from the frame is varied by holding different knots against the upper part of your cheek, just under the eye, until the frame includes the desired picture. A lens of corresponding focal length is adjusted to the camera. On my camera, I use lenses of 4½ to 16½-in. focus. The outside dimensions of the card enable one to carry it with the plate holders.—W. H. Wilcox, Tacoma, Wash.

Dry-Cleaning Mixture

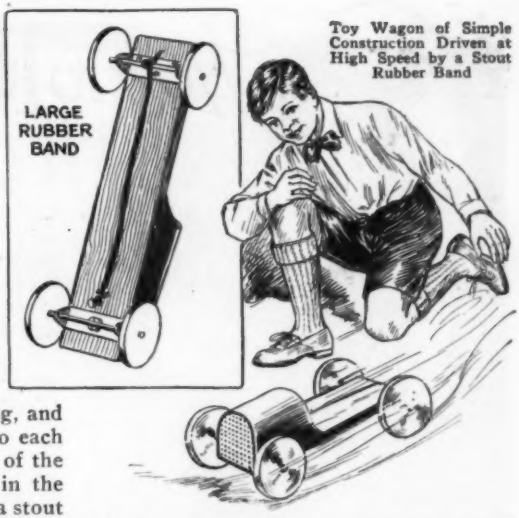
An emulsion of gasoline and water is much used by dry cleaners for removing grease, tar and paint spots from clothing. It is in the form of a thick, white sirup, which evaporates entirely and is not injurious to any fabric or color. This emulsion can be prepared as follows: Dissolve, in 1 qt. of boiling water, ½ oz. of pure castile soap and ¼ oz. of gum arabic. Allow this to cool, and then add 1 oz. glycerin, 1 oz. strong ammonia water, 1½ oz. chloroform, and 2 oz. sulphuric ether. Shake well, and pour enough of the mixture into a quart bottle to fill it for ¾ in. On top of this pour gasoline to raise the level ¼ in., and shake until creamy. Repeat the addition of gasoline, shaking each time, until the bottle is full. The cleaning mixture will then be ready for use, and may be applied with a rag or with a small brush. If, on adding the first lot of gasoline and shaking, the mixture does not become emulsified, too much gasoline has been added. In this case, allow the mixture to stand for a few minutes and pour off the excess gasoline, which comes to the top. Shake well, and add a smaller quantity of gasoline. When the bottle is half full, larger quantities of gasoline may be added at a time. It is interesting to note that the more gasoline is added, the thicker the emulsion becomes, and if the addition of gasoline and the shaking is prolonged, a semisolid jelly is formed, which will not run from the bottle. Keep the emulsion away from open flames.

Conserving Motor Heat in Zero Weather



Fitting a shutter in front of the radiator of your car is highly recommended to keep the heat of the motor at an efficient operating temperature, and the provision of cardboard or asbestos strips inside the lower part of the hood to close the ventilating slots, is also advisable. Besides this you will find that asbestos "fluff," which is used for steam-pipe packing and is obtainable at almost any mill-supply house, provides considerable insulation when stuffed between the dust and oil pans of your car, as shown in the drawing. —R. P. Cole, Paterson, N. J.

Toy Speed Wagon

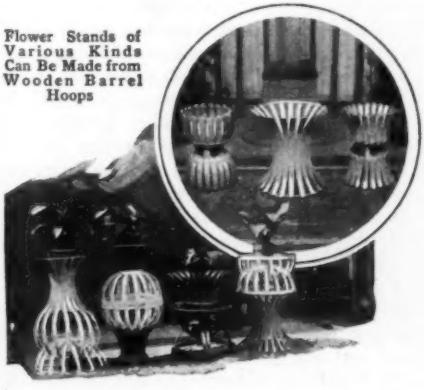


Toy Wagon of Simple Construction Driven at High Speed by a Stout Rubber Band

Provided with a stout rubber band, this speed wagon will travel at a fast clip for more than 100 ft. One model has covered 250 ft. on a single winding. To make it, get four can covers for the wheels; cut 2 strips from the side of one can, bend the ends over at right angles and punch holes through them to serve as bearings for 2 lengths of wire which serve as axles. Push the wires through holes punched in the exact center of the wheels, and then solder the wheels to the axles. Cut a narrow board, about 2 ft. long, and fasten one set of wheels and axle to each end. Drive a nail in the underside of the board just behind the front axle, in the center, as shown in the detail. Get a stout rubber band and tie one end to this nail. Then wrap the other end of the band around the rear axle and turn the wheels to wind the band on it. If you stretch the rubber while winding, you can wind it much tighter. Set the wagon down on the floor and let it go. In one case the band was wound so tightly that the wheels would spin, unless a brick was placed on the wagon. To make the wagon run in a curved path, turn the front axle slightly, which can readily be done if it is attached by means of a screw driven through the center of the tin strip. You can also add other details, such as a hood, seat, steering wheel, radiator, etc. File all edges down so that they are as smooth as possible, and when you wind the rubber, take care not to let the wheel spin in your hand, for even a smoothed tin edge may make a bad cut.—Dale R. Van Horn, Lincoln, Nebr.

Flower Stands Made from Barrel Hoops

Wooden barrel hoops can be used for making artistic flower stands like those shown in the drawing. They can be made of various shapes and sizes and, when finished, are given an application of paint to add to their appearance.



Flower Stands of Various Kinds Can Be Made from Wooden Barrel Hoops

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Care of Automobile Doors

When you are oiling your auto, do not neglect the door hinges and latches. Many rattles and squeaks can be traced to door hinges and old anti-rattling devices. Slamming doors too violently is apt to break the door-window glass, or it may spring the door, and it is then almost impossible to prevent it from rattling. For the same reason, it is a good plan to examine the door checks occasionally.

¶To level rough ground quickly and effectively, drag an iron rail over it, tying each end to a suitable length of chain or rope and attaching it to a tractor.

How to Refinish

Finishing with Stain and Varnish

Be Sure That All Sanding Dust Is Well Rubbed Off Before Starting to Varnish

IN THIS issue we are going to take up the extra-fine stain finishing of furniture by removing the old finish and building up the desired new finish by coloring the wood with stain, and then applying finishing coats of varnish. This is the method skilled finishers use in refinishing operations of the highest class.

We will take for an example an end table in the red-mahogany finish which used to be fashionable but now is no longer seen in the best-furnished homes, and change it to the modish brown mahogany of today. In this connection, it is to be assumed that there are only two reasons why the householder will ordinarily want to remove the old finish and build up a new one from the wood. One is to change the effect, and the other that the old finish is in such bad condition it cannot be restored to its original state by patching, polishing or the application of an additional finishing coat. It should, of course, also be remembered that the stain finishing of fine furniture calls for the exercise of considerable good judgment, and that those without previous experience in the use of finishing materials should first do some smaller, medium-grade pieces to be sure the results obtained are satisfactory before attempting expensive furniture.

Ordinarily a previously stained piece can be refinished in a darker stain effect with satisfactory results, but wood previously stained dark can seldom be satisfactorily refinished in lighter effects. Red-mahogany stain in particular is very powerful, and it is practically impossible to use any except the very dark stains, such as walnut or brown mahogany, for refinishing surfaces previously finished in red mahogany, as the stain deep down in the wood, which cannot be entirely removed, will "bleed" through and "muddy up" the new finish, so it will not present a very pleasing appearance.

In starting the refinishing of the table, the first step naturally will be the removal of the old finish. This is not a difficult operation, although it is rather a disagreeable one to those who are not accustomed to it. The work is best done with the prepared paint and varnish removers made especially for the purpose. Alcohol is sometimes used, as is also benzol and other solvents, but they do not act so quickly and efficiently as the prepared removers. Lye is also employed, but its use is not advisable, as it is likely to burn the wood and injure it for refinishing. Some people also sandpaper down the old finish instead of using paint and varnish remover, but this is not such a satisfactory method, for it is impossible to sand out checks entirely as long as any of the old finish remains, and to sand it

Your Old Furniture

by Berton Elliot

down clear to the wood is a hard job, and a much longer one than the removal of coatings with a solvent remover.

The method of using paint and varnish remover is as follows: Brush a liberal coating onto the surface, being sure to shake the container thoroughly to agitate the contents, immediately before using, and also being careful not to get any of the remover onto any near-by painted or varnished surfaces. Allow the application of remover to remain on the surface until the old coating is softened, which usually takes about five minutes, then scrape off the softened coating with a putty knife. Carvings, moldings and other hard-to-get-at places may be reached with a small vegetable brush or a piece of steel wool (which should be fine) dipped in the remover. In some cases where the old finish is exceptionally heavy or adheres tenaciously to the surface, a second or third application of the remover may be necessary, but not as a general rule. After the removal of the old finish has been completed, the surface should be thoroughly washed with a cloth saturated in gasoline (preferably high-test) or benzine, or, better still, scrubbed out with a vegetable brush dipped in the gasoline or benzine, to remove any remaining deposits of the paint remover. This is extremely important, as paint removers are ordinarily made with a wax content, which, if left on the surface, will interfere with the drying of the new finishing coats or cause other trouble.

Applying Rubbing Oil to the Surface When Polishing with Rottenstone

As soon as the surface is thoroughly dry, you are ready to build up the new finish. The first step, as in all finishing, is to sandpaper the surface. While it may seem to be quite smooth,

Top, Sopping On the Remover; Center, Staining the Piece; Below, Rubbing Off Filler across Grain

it is always wise to sand lightly before any finishing is started, to take off any nibs or dirt and insure the last degree of smoothness. For fine finishing, only very fine sandpaper should be used (not coarser than 0000). Care should be taken to sand evenly all over the surface, so that the refinishing coats of stain will produce a uniformly even effect. When through, loose particles of sand and sawdust should, of course, be dusted off carefully.

The next operation is the application of the stain. For the home finisher, a stain of the penetrating type is best. Oil stains, although suited for use by the amateur, are only adapted to new wood, as when a wood has once been filled, stained and varnished, its porous qualities are partly destroyed, so that oil stains will not penetrate sufficiently. There are other types of stains which require more skill in application and therefore should be used only by the skilled craftsman. Before starting to apply the stain, a try-out should be made on some obscure part of the table, as it should be remembered that a stain gives somewhat different color effects when used on different kinds of woods, and also varies somewhat according to the previous finish and the quantity of stain that may be left in the wood when the old finish is removed. If the effect is found to be too dark, the stain can be lightened somewhat by adding a little turpentine.

The application of the stain itself is a comparatively simple operation. One coat only should be applied, as evenly and uniformly as possible, without covering any part of the surface twice. If any places are skipped, touch them up with a small brush. After staining, the surface ordinarily should not be sandpapered, as it may cut through the color in places.

The next step is the application of filler, if the piece is of one of the open-grain woods, such as oak, walnut, mahogany, chestnut, etc. This should be done after the stain is thoroughly

dry, usually the following day. While the wood, if of the open-grain type, was undoubtedly filled when the piece was originally finished, the application of the paint and varnish remover usually removes some of the filler as well as the finish.

The function of the filler is to fill the pores of the wood, so that the following varnish coats do not sink in, and to level the surface for the finishing coats. Ordinarily paste filler is used for open-grain woods, this material coming in thick paste form, to be reduced with benzine or turpentine to about the consistency of thick cream immediately before use, and being made in different shades, such as natural, oak, walnut, mahogany, etc. The color of the filler should correspond with the effect desired.

Filler is applied with a brush, and, within a few minutes after application—as soon as it commences to set, which is indicated by its turning flat—is wiped off across the grain with a cloth, rubbing vigorously until every bit of surplus is removed, the last stroke or two being with the grain. The filler should not be applied on too much surface at a time, for if it sets hard before you get it wiped off, it will be hard to remove, and this must be done or the finish will be disfigured with grayish streaks. In case it should get too hard, it will have to be washed off with turpentine or benzine, or perhaps taken off with sandpaper dipped in turpentine or gasoline. When the filler has dried for 24 hours, the surface should be sandpapered very lightly, and dusted clean.

The next operation is the application of a thin coat of shellac, to seal in the stain, which would otherwise bleed through the finishing coats of varnish. Shellac, being made with alcohol and containing no linseed oil, is impervious to the attack of the strong dyes used in penetrating stains, which attack linseed oil. For use over brown mahogany, walnut and the darker shades, orange shellac is recommended, as its yellowish cast helps to bring out the true beauty of the effect. (For light-stain effects, white shellac should be used.) After the shellac is dry—it dries very quickly and becomes thoroughly hardened in about two hours—it should be sandpapered lightly to a smooth surface, but not too much, so as to sand it off entirely.

Rubbing Down between Coats with Fine Sandpaper on Felt Pad

After dusting clean, you are ready for the finishing coats of varnish.

For the highest-class work, three coats of high-grade interior-finishing varnish (gloss) should be applied, allowing three, or preferably four, days for drying between coats, and rubbing the first and second coats with No. 0000 sandpaper (or, for the best possible job, with pumicestone and water) and the final coat with pumicestone and oil, to the desired effect. Full directions for pumice rubbing were given in the December, 1928, issue of this magazine, and detailed information regarding the technique of applying varnish in the March, 1929, issue.

A high polish of piano finish is sometimes given fine furniture by rubbing with rottenstone (which can be obtained at paint or drug stores) and oil, after the pumice rubbing is completed. Simply rinse off the pumice with clear water, and begin rubbing with rottenstone and oil, using a very soft cloth or soft rubbing felt, and proceeding over the entire surface until a beautiful high polish is produced. Then rinse off with clear water and dry with a chamois or soft cloth. In case any places are found to be dull after the clean-up, they should be rubbed to

ished furniture, and you will have a piece that compares with the mahogany or walnut-finish furniture shown in the stores.

When using the decalcomania transfers, it is, of course, necessary to choose a pattern that will imitate a wood inlay, that is, one that resembles the background as closely as possible. Bright, highly colored transfers, while quite suitable for painted, lacquered or enameled furniture, are entirely out of place on stained and varnished pieces. There are many transfers, however, that resemble inlay and marquetry work, in comparatively dull colors, and any good paint house can offer a selection that will enable the amateur finisher to suit his walnut or mahogany pieces. Take care to place the transfer accurately. If it is off center or not straight, it will mar the effect of the most careful finishing.

match the rest of the surface; then the entire surface is given a few strokes to produce a uniformly even effect, and cleaned off thoroughly when through.

From the foregoing, it will be seen that the refinishing of an old piece of furniture in a fine stain finish is really quite a simple operation for anyone who likes handcraft. There are just these five operations: taking off the old finish; applying the stain; applying the filler; applying the varnish coats, and rubbing (and polishing if desired).

Then, if desired, a last finishing touch can be added by the application of transfer decoration in one of the medallion patterns or wood-inlay effects designed especially for use on stain-fin-

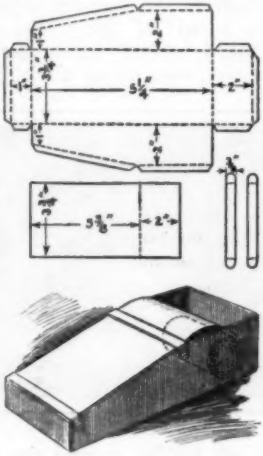
Scraping Off Softened Varnish with Putty Knife after Sopping with Remover

Removing Auto Wheel without a Puller

If you have to remove a rear wheel of an auto and there is no wheel puller at hand, jack up the opposite wheel, setting the jack at a slight outward angle so that the weight of the car pulls on the axle of the wheel to be removed. Take off the hub cap and the hub nut, reverse the nut and screw it on the shaft until it comes flush with the axle, and tap the axle with a hammer until the wheel comes loose. The nut is reversed so that no damage will be done to the castellations. I have found this method successful with the tightest wheels.—K. E. Corliss, Langley, Wash.

Memorandum Pad and Holder

One of the most useful types of memorandum pads is one that incorporates a roll of paper, which can be torn off at any length desired. It is easy to make one from a piece of tin, brass or galvanized sheet iron, the dimensions and shape of which are given in the upper detail. The dotted lines show where the metal is bent. Two ⅜-in. metal straps are soldered onto the sides at the top and bottom of the pad holder as shown, a slight space being left between them and the holder. In use, a roll of paper is laid in the box section and the end pulled between the top and the straps. If desired, the holder may be given a coat of lacquer to improve its appearance. All the sharp edges, are, of course, smoothed with a file or piece of sandpaper. The used paper is torn off by pulling against the bottom strap, as on a wrapping-paper roll.—H. J. Wubbold, Salisbury, Md.

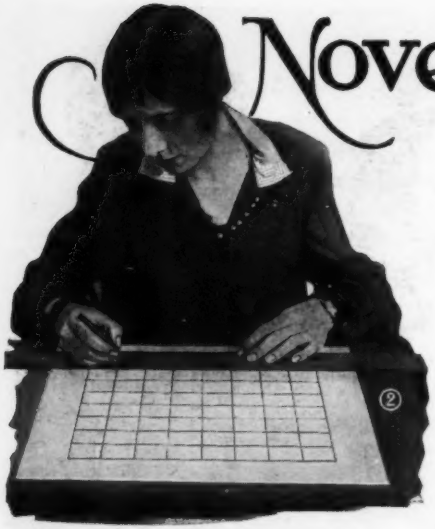


You Can Prevent Loss of Your Motor by Tying It to the Boat with a Six-Foot Rope

Preventing Loss of Outboard Motor

Some time ago, when attaching an outboard motor to a boat in rather rough water, I overbalanced with the result that the motor and myself had an untimely bath. It was quite difficult to recover the motor in 15 ft. of water, and I decided to prevent a similar accident by fastening a 6-ft. length of rope to the motor before lifting it out of the boat. A harness snap, fastened to the shank of the wingbolt of the motor clamp, provided a quick means of attaching and detaching the rope. Of course, the other end of the rope was securely tied to the boat. Another simple method of preventing the loss of the motor, due to vibrations loosening the screws clamping the motor to the boat, was found successful on a Wisconsin lake. A piece of 1/16-in. sheet copper was bent to fit over the transom of the boat, and screwed to the wood. The motor fits over the copper in the usual way, but the clamp screws get a good grip on the soft metal, and do not seem to become loose. A combination of both methods described should prevent any possibility of loss or trouble.—Dick Cole, Los Angeles, Calif.

Novel Effects *from*



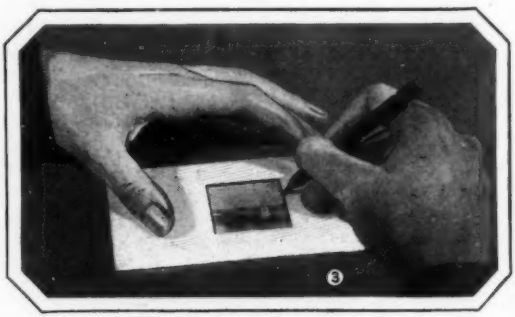
OF COURSE you have a camera. Every summer you go on a grand spree of picture taking—snaps of the fish you catch, artistic and unartistic photographs of your friends and relations, a beautiful bit of scenery; in fact, everything from a mud turtle to a midsummer sunset is fit material for your black box. And then, at the end of an arduous summer, you take the vast collection, look them over for the last time, and then plank the whole bunch in a shoe box with the rather vague intention that some day you will take them out again and put them in a pretty album where they can yellow away to a decent old age with some pretense at luxuriousness.

That's the average amateur photographer. Like a lot of others, you take a picture and that ends it, and you never give a thought to the wonderful decorative effects that can be obtained from the camera and your old snapshots.

But here's what you can do: Go over your accumulation of snapshots. Among them you will, of course, find two or three dozen or more pictures which you especially like, and from these a photographic checker or chessboard, as shown in Fig. 1, can be made.

In making this checkerboard, the first step is to procure a sheet of heavy white cardboard or bristol board, 16 in. square. Now, measure in 2 in. from each edge of this square and rule another square to form a border, 12 in. along each side. Divide this inner square, with ruler and T-square, into 64 small squares, as shown in Fig 2, each of these smaller squares measuring exactly 1½ in. to a side.

That finished, take a small piece of cardboard, and in the center of it cut out an opening 1½ in. square. This is the "finder." By placing it in various positions over a snapshot, you are enabled to select the most picturesque or interesting bit of the picture, and after finding it, you should outline it by running a pencil around the inner edge of the cardboard square, as shown in Fig. 3. Your snaps, of course, should be of the 2¼ by 3¼-in. size, at least, so that there will be plenty of detail in the pictures, although 1⅝ by 2½-in. "vest-pocket" snaps will do in a pinch. Outline 32 of your best snaps in this manner, and then cut out each of the squares with a paper cutter or a pair of sharp scissors, as shown in Fig. 4. After cutting the snapshots, take a pen, and, filling it with black ink, run a black border around the outside of each square, as shown in Fig. 5.

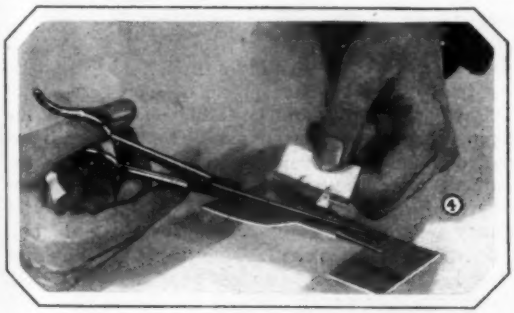


The next step is to mount the photo-

your Old Snapshots

by Sam Brown

graphic squares on the ruled sheet of cardboard. In doing this, 16 of the pictures should face one way and 16 the other, so that each player will have 16 pictures facing in his direction, as shown in Fig. 6. The final step in the construction of the checkerboard proper is the border. If you have the necessary artistic ability, a simple pen-and-ink border can be drawn around the framework of photographic squares; if not, the simplest method is to paste a narrow strip of suitable wallpaper border around the edge, mitering the corners so that the edges will fit nicely together. A small, diamond-

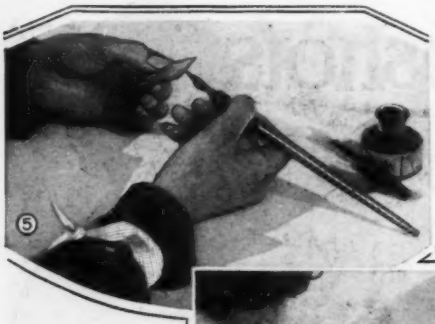


shaped or circular photograph can then be pasted in each corner, as in Fig. 7.

Now cut, from 3/8-in. lumber, a piece of the same size as the cardboard and paste or glue the checkerboard to one side of this. Cut a piece of heavy glass to exactly the same size as the board and place this over the top of the layout of photographic squares. Bind the edges of the three assembled pieces with a 2-in. strip of colored felt, cutting the felt at an angle every 16 in., as shown in Fig. 8, so that it will make a neat joint at the corners, as shown in Figs. 8 and 9.

Almost finished! It remains yet to glue a square of felt to the bottom of the board so that it will not mar the surface of the playing table, and then—your move!

A neat top for a card table, as shown in Fig. 10, can be made in a similar manner, and here the scope for artistic grouping of large and small pictures is considerably enlarged. The various steps in the construction of the photographic card table are much the same as those used in making the checkerboard. If desired, the photographs can be pasted directly to the surface of the table (this should be light in



puzzle is finally assembled, as shown in Fig. 12. This particular puzzle was made from an enlarged snapshot of the Harding Memorial, at Marion, Ohio, but any other type of picture—landscape, personal, marine, etc.—can be used to equal and often to greater advantage. A small boy would surely appreciate puzzling out his own picture over assembling a photograph of a locomotive, of a beauty spot in the Grand

color in order to contrast) instead of to a sheet of cardboard, although the latter is the better method. The binding for the card table can either be felt, as for the checkerboard, or narrow brass strips (such as are used for the edges of oilcloth-covered tables), bent at right angles, can be used to hold the glass in place.

Something entirely different is the photographic cut-out puzzle. Take one of your best snaps and have it enlarged to about 7 by 10 in. Mount this enlarged picture on one side of a thin slab of wood, preferably three-ply veneer, so that it will stay flat, using a good grade of glue to hold the photograph firmly in place. After the glue has set and dried, take a coping saw or a fretsaw and cut the mounted photograph into small sections, as shown in Fig. 11. This can be done haphazard or from a penciled pattern, as your fancy dictates.

In cutting the photograph, downward pressure should be used only on the outward stroke of the saw, as a heavy, downward pressure on the backstroke tends to give a slightly ragged edge to the picture which will mar its appearance when the

canyon or striking scenic view elsewhere.

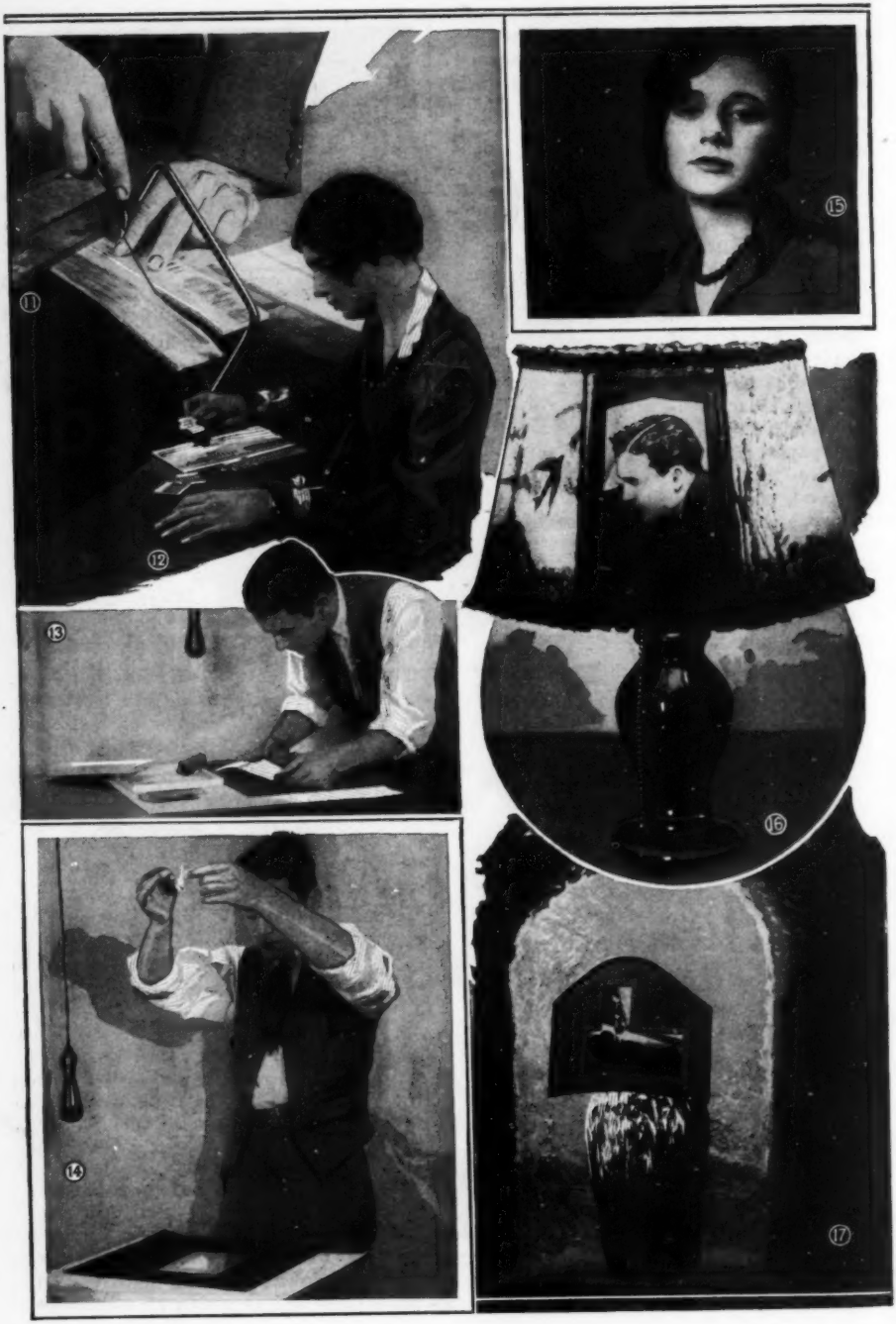
Still another phase of decorative photography from your old snapshots is the making of transparencies. A transparency is a positive film; that is, the snapshot film appears like a snapshot photograph made transparent. The varied uses for these transparencies are legion, but, perhaps, in the making of lampshade decorations they are most popular.

The how of making them goes like this: Take about six of your favorite negatives and retire to a room which is entirely darkened with the exception of a dim light furnished by a red electric bulb or

by an ordinary white bulb masked with red paper. The red paper that films are wrapped with in the original package makes a good safe light. In this dark room, take a roll of film of the size that fits your camera and unwind it. After procuring the length of film, cut it with scissors into six small pieces of a size to fit your negatives, as shown in Fig. 13.

Now, take one of the pieces of the new film and place it on a piece of black velvet, felt, or dead-black paper. Put the negative film over this, and, on top of the two, a clean piece of glass. That done, take an ordinary match. Light it. Hold it about 2½ ft. away from the glass, as shown in Fig. 14, and allow it to burn for the duration of the initial flame caused by the head of the match. The match should be waved slightly to and fro as the exposure is being made, and this exposure should be of no longer duration than the match-head flame mentioned, as further exposure will "burn up" the film.

What happens is quite obvious. The light penetrates through the light and dark portions of the film negative and makes a positive impression on the lower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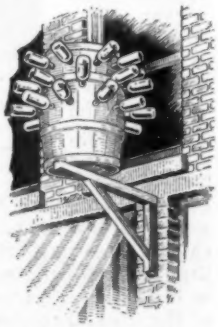
film. This positive imprint, when made in this fashion, is technically known as a transparency. After making the usual six exposures, place the prospective transparencies into a black box and take them to your photographer. He will develop them in the usual manner, producing positive films like the one shown in Fig. 15.

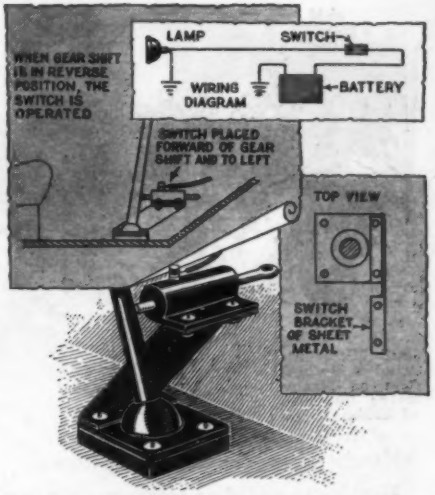
The practical value of these films lies in the fact that their transparency makes them quite suitable for mounting on lampshades and side-bracket lights.

The first step in mounting them is to cut out the necessary area from a plain undecorated lampshade, or perhaps you can find a parchment lampshade with a design which readily permits the cutting out of some portion to allow the insertion of the picture. After cutting out the framework, trim the transparency to the required size and paste it in place on the inner side of the shade. A piece of transparent paper should be used as backing, in order to give the picture more brilliancy. Some idea of the effect can be gained by the illustrations in Figs. 16 and 17, although the full delicacy of the transparency is something far too illusive to be reproduced on the printed page. The effect can be varied by using thin colored paper to back up the transparencies, or thin colored celluloid, the color being chosen to suit the subject.

Novel Sign for Roadside Pop Stand

The proprietor of a small roadside pop stand, just outside of a small Nebraska town, has a novel advertisement which is especially attractive at night. It consists of a 5-gal. keg bored to admit the ends of empty pop bottles as shown. A 150-watt electric lamp is provided inside of the keg, and the open end of the keg is closed. At night, when the light is turned on, the bottles let the light through, making the odd sign visible from the road.




LAMP
SWITCH
WIRING DIAGRAM
BATTERY
WHEN GEAR SHIFT IS IN REVERSE POSITION, THE SWITCH IS OPERATED
SWITCH PLACED FORWARD OF GEAR SHIFT AND TO LEFT
TOP VIEW
SWITCH BRACKET OF SHEET METAL

Back-Up Light Which Works Automatically When Car Is Reversed

Installing a Backing Light on the Car

Any motorist can provide a back-up light that works automatically when the gear-shift lever is thrown into reverse. Get an ordinary stop-light switch and mount it on a bracket, which is in turn attached to the transmission cover as shown. The switch is so located that the gear-shift lever bears against it and closes the circuit. A 4-in. spotlight is mounted at the rear in a convenient position. The small diagram shows the method of connecting the lamp and switch in the circuit. —G. A. Luers, Washington, D. C.

Soldering Iron Removes Putty

Putty can readily be removed from old window sash in which the pane has to be renewed, by means of a red-hot poker or hot soldering iron. An electric iron with a wedge-shaped point is the best for the purpose as it remains hot. After getting the point down to the wood it can be pushed along, peeling the old putty clean without damaging the wood on the sash. —Mason Barnard, Worcester, Mass.

¶Half of an old flour barrel, cut lengthwise and laid on the ground with stakes driven in at the open end, makes an excellent coop for a brood of young chicks.

Small Mirror Attached to Swivel Joint on Handle Helps Inspection of Hidden Places

Handy Mirror for Inspecting Corners

Machinists and shop workers often find it necessary to inspect a corner which is out of the line of vision and can only be seen by the use of a mirror. In such cases a small mirror taken from a cosmetic compact and attached to a handle so that it can be adjusted, will be found "just the thing." Remove the mirror from the lid and solder a ball-and-socket joint to the outside edge of the lid. Joints of this kind can be found on gas-throttle rods and distributor rods of autos, and can be picked up for a few cents at any auto junk yard. Tighten the socket on the ball until it moves rather stiffly. Screw a piece of the rod into the joint and attach a wooden handle, about 7 in. long, so that the complete handle will be 10 in. long. When entirely finished, replace the mirror. Such a tool will be found useful for inspecting corners inside of tanks and boilers with a flashlight for illumination; for checking timing gears without removing the radiator, and for inspecting and timing a magneto without removing it.—C. Neiper Bruce, New Castle, Pa.

Quickly Made Soldering Acid

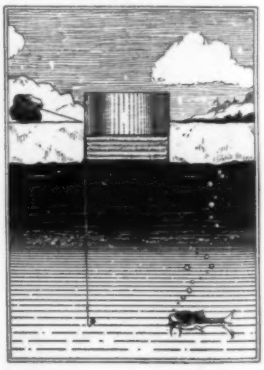
Preparation of soldering acid by dropping pieces of zinc into muriatic acid until all bubbling has ceased, which indicates that the acid has been properly cut, takes a long time and is more or less messy. An equally effective flux can be made from a few cents' worth of zinc chloride mixed in water to make a saturated solution. The flux thus made is ready for use as soon as it is mixed. As the salt is extremely deliquescent it should be kept in an air-tight bottle.—J. S. Hagans, Chicago, Ill.

Warning Signal for Low Beam in Cellar

There are quite a number of cellars in which the center beam is lower than the joists, and no matter how careful you are, you occasionally will bump your head against it painfully. After this had happened to me a number of times, I decided to prevent repetitions by providing a warning signal that I would see when approaching the beam. I had noticed that most people walking down into a cellar have their eyes fixed on the floor and therefore I got a paintbrush and some black paint and marked a line on the floor directly under the beam. When I catch sight of the line, I always remember to stoop.—J. A. Dowie, Alexandria, Va.

Fishing through the Ice

When fishing through a hole in the ice the hole is likely to freeze over during the night unless it is covered. Sometimes a piece of paper or cardboard is laid over the hole and this is covered with straw or hay, but the disadvantage of this method is that, unless it is securely weighted down, the straw may be blown away. A better method, which I have found successful, consists in setting a piece of corrugated cardboard, roughly shaped to form a tube, into the hole and then filling the top of the tube with straw or hay. A little water applied to the edge of the ice and to the outside of the tube will soon freeze and hold it securely in position.—Dale R. Van Horn, Lincoln, Nebraska.

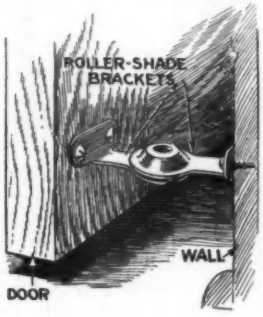


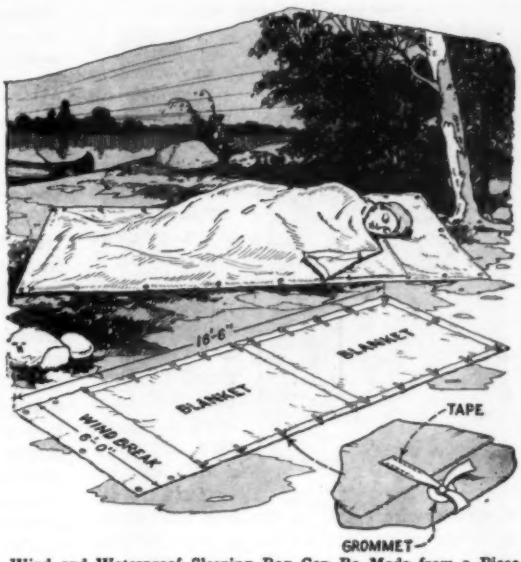
How to Grow Dwarf Trees and Shrubs

Dwarf trees and shrubs of the Orient are famous the world over. If you enjoy gardening or experimenting with such trees and shrubs, here is a simple method of growing them in your own home. Carefully remove the pulp from a half grapefruit or large orange. Let the peel dry to some extent and then apply a single coat of shellac or varnish on the outside. When dry, fill with the finest and richest leaf mold you can get. Rich fertilized earth will do in a pinch. In the center of the shell, plant a tiny seedling of the tree or shrub you wish to dwarf. Set in a sunny place and water occasionally. As the seedling grows, the roots will eventually pierce the sides or bottom of the fruit-skin pot. With a sharp knife, or scissors, trim each projecting root flush and apply varnish or shellac on the wound. Repeat this operation for a few months and then transplant the tree to a pot or jardiniere of suitable size. Pine trees, orange, lemon and quince trees are the easiest to work with, although there are countless varieties suitable for experimentation.—M. W. Meier, Langley, Wash.

Simple Door Holder

Two shade-roller brackets, one attached to the baseboard and the other to the door so that they will engage as shown in the drawing, will be found efficient as a door holder. The concavity of the brackets and their smooth edges, cause them to engage easily when the door is pushed open, and similarly to slip apart readily when it is closed.—R. Wailes, Bethesda, Md.





Wind and Waterproof Sleeping Bag Can Be Made from a Piece of Canvas and Two Blankets

Combination Shelter and Sleeping Bag

When one does not feel justified in purchasing a sleeping bag, a good substitute can be made cheaply and without much work. The materials needed are one piece of duck about 6 by 16½ ft., the weight being determined by the user according to his needs for shelter, and 2 doz. brass grommets with ½-in. holes. Also get a few yards of good stout tape, thread and needles. Space the grommets about 15 in. apart on the long edges of the canvas. Then sew 1-ft. lengths of tape to the edges of your camp blankets, spacing them to match the grommets in the canvas. It is a good idea to have the lengths of tape sewed on by machine. In use, the canvas is laid down flat as shown in the drawing. The blankets are laid on it, and the lengths of tape are tied to the grommets. Fold one blanket over the other and there will then be exactly 2½ ft. of canvas projecting at the head end of the bed thus formed. Tie up one edge of the bed all the way, using heavy fishline, rove through the grommets back and forth from end to end. This will make the edge practically windproof. The other side is similarly tied, halfway up or entirely.—Dick Stafford, Boulder, Colo.

Pocket First-Aid Kit

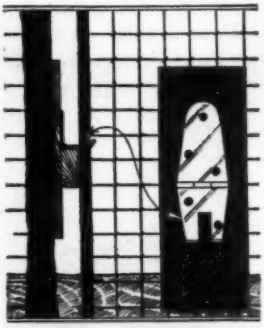
Handy and compact, features which are appreciated by hunters and campers, are the requirements of a pocket first-aid kit. I have found no better container for such a kit than a small tobacco can of the kind shown in the drawing, which can be obtained almost anywhere. Give the box two coats of white paint and, if desired, paint a neat red cross on one side. Have the druggist put up the following items in slender 2-drachm tubes: aromatic spirits of ammonia; soda-mint tablets; iodine or mercurochrome; a saturated solution of permanganate of potash, which is used for insect bites and stings; 10 drops of oil of cloves in sulphuric ether, this being used as a toothache remedy; a small roll of adhesive tape, removing the tape from the container and filling the latter with zinc oxide which is used as a burn ointment; a roll of 2-in. gauze; a small package of absorbent cotton and a square of surgeons' lint, which is sold in waxed envelopes about 6 in. square. To assemble the kit, take about half of the absorbent cotton and place it, tightly rolled, in the bottom of the can. On this stand four of the tubes vertically. Place a small pair of scissors between the tubes and the side of the can. Add some rubber bands and toothpicks and the surgeons' lint. A small card or paper, containing straight pins and some small safety pins, besides a needle and thread, is then inserted. A pair of tweezers can also be accommodated. On top of the tubes lay the tube of soda mints on its side, and above this place the tin containing zinc oxide, and about half of the roll of gauze. A small piece of soap and the tape can then be fitted in a corner. Be sure that the corks on the tubes are all tight. This kit is the result of fourteen years' experience. —Harold J. Boyd, Orlando, Fla.

Enlarging Small Negatives

Amateur photographers who enlarge small negatives and find that the grain of the gelatin emulsion is objectionably magnified in the process, may counteract this trouble by simply immersing the negative in a liquid which has nearly the same refractive index as the negative and the base. Such a solution may be carbon tetrachloride, benzine, turpentine or glycerin. In a horizontal enlarger these solutions should be used in a tank, made by clamping a strip of soft rubber between two sheets of glass, or in a vertical enlarger a clear glass tray can be used. A simple method is to sandwich the negative between two glasses after covering both sides with a thin coating of glycerin. If the enlarger radiates much heat, it is best to treat the film with a hardening solution, such as formalin, before immersing.

Hinge Makes Good Gate Latch

Any large strap hinge can be converted into a good gate latch. With a hacksaw or cold chisel cut off one end as indicated by the dotted lines, and recess the remaining portion so that it is wide enough to fit over the gate frame. Screw the hinge to the fence post as shown, and nail on a block to keep the latch end horizontal. Bend the ends of the latch section upward a trifle so that it will slip into its locking position more easily after it has been lifted to release the gate. If the gate is required to swing in one direction only, a stop block may be nailed onto the post, and an unslotted hinge can be used in practically the same way with just sufficient clearance between it and the stop block to accommodate the gate frame.

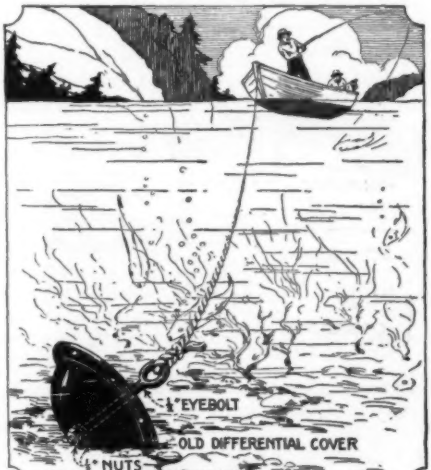


Using Gasoline Stoves and Lanterns

Gasoline treated with lead tetraethyl, so-called "ethyl gas," cannot be used instead of "straight" gasoline in stoves and lanterns. Exhaustive tests seem to indicate that ethyl gas relieves the knock in a motor by retarding the explosion, and many users think that it is a gas of exceptionally high-test quality. Gasoline, however, merely holds the lead tetraethyl in solution in the same way as salt is held in water. When the gas is vaporized in the generator of a gasoline stove or lantern, a solid residue is left, which quickly plugs up the orifice in the generator tip. Then the stove ceases to burn. Campers who siphon fuel from their auto tanks should be aware of this.

Bell Anchor for a Small Boat

An old differential-housing cover plate, fitted with an eyebolt as shown in the sketch, makes an excellent bell or mushroom type of anchor for a small fishing boat. This anchor does not depend on its gross weight to hold a boat. It digs into the sand, gravel or mud at the bottom and is therefore more effective than a heavier plain-weight anchor. When drawn to the surface, its accumulated contents can be rinsed out before lifting it into the boat.—Dick Cole, Los Angeles, Calif.



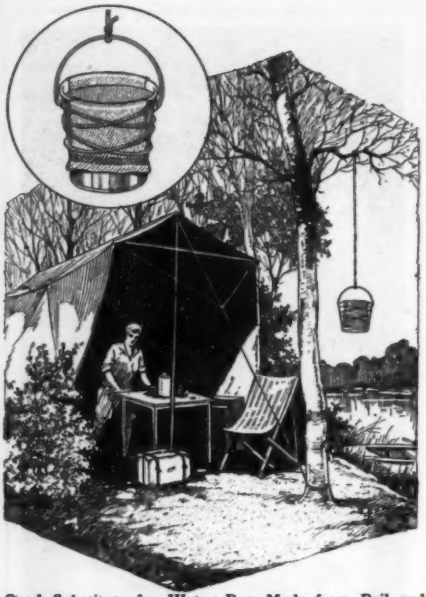
Effective Bell-Shaped Anchor Can Be Made from Old Differential-Housing Cover Plate

Convenient Transplanting Box Consisting of Jogged Strips of Sheet Metal

Making Transplanting Easier

A sheet-iron box, with removable partitions forming a number of compartments, will facilitate transplanting. For ordinary plants, make the box 3 in. deep and from 20 to 27 in. square, depending on the size needed. For the partitions, get strips of sheet metal and bend them at 3-in. intervals as shown, first to the right and then to the left. These bends should be true right angles so that the strips can be slipped out when necessary. On each side of the jogged strips straight strips are provided. Fill the compartments thus formed with rich earth and plant the seeds. When the plants have reached the desired size, transplant them. Remove a whole row, which can be conveniently done because of the jogged strips, and it is then an easy matter to separate the individual plants.

¶When lighting matches in the wind, spread an envelope by pressing on the edges and use it to shield the flame.



Good Substitute for Water Bag Made from Pail and Towels

Substitute for Water Bag

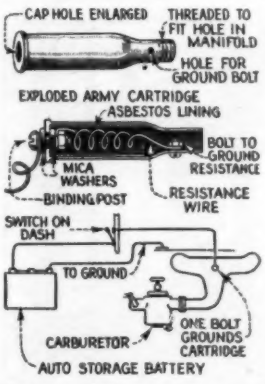
Nearly everyone knows the value of a water bag for supplying a cooling drink when ice is not available. If none is at hand, a good substitute can be had by wrapping wet towels around a pail of water suspended in a breeze. The edges of the towels should overlap the rim of the pail and dip in the water. The cloth acts as a wick and draws up sufficient water to keep the towels moistened. The evaporation of the water in the towels cools the contents of the pail. It is well to cover the pail with a piece of cardboard, and if no breeze is blowing, to swing the pail on a rope tied to the limb of a tree.—Dick Cole, Los Angeles, Calif.

Screw-Slotting Hacksaw Blades

Every mechanic's tool kit should contain a set of four screw-slotting hacksaw blades. These are similar to the ordinary blade, but are wider, and each of a set of four is of different width, the widest being ⅛ in. It is obvious that the set will save the metal worker considerable time in cutting slots and grooves. Slots wider than ⅛ in. can be made by making the second cut parallel to the first. Little or no dressing up is necessary when the job is finished.—J. S. Hagans, Chicago, Ill.

Homemade Gas Vaporizer for the Auto

Here is a gas vaporizer that will help to start your car quickly on a cold day. It consists of an army-rifle cartridge shell threaded at the small end to fit a tapped hole in the gas-intake manifold. The cap hole is enlarged so that a screw slipped through two mica washers, one on the inside and the other on the outside of the cap, will not touch the shell. A hole is drilled through the side of the shell at the small end for another screw, but this one, unlike the first, must make actual contact with the shell. A piece of asbestos paper is cut so that, when rolled to form a cylinder, it will fit snugly inside the large part of the shell. Get a length of resistance wire, as part of the element from a discarded electric-heating unit, wrap it around a nail to form a small coil and connect it to the two screws on the shell, as indicated in the illustration. Screw the shell into the hole you drilled in the intake manifold. Connect the screw on the cap of the shell to one side of a switch, which may be mounted on the dash or instrument board, and connect the other side of the switch to the ungrounded side of your storage battery. By closing the switch so that current will flow through the resistance wire in the shell, considerable heat will be produced almost instantaneously, and this will enter the intake manifold, vaporizing the gas before it reaches the cylinders. —Clyde E. Volkers, Terre Haute, Ind.



¶A mixture of four parts sodium fluoride and one part of pulverized sugar is effective in destroying ants.

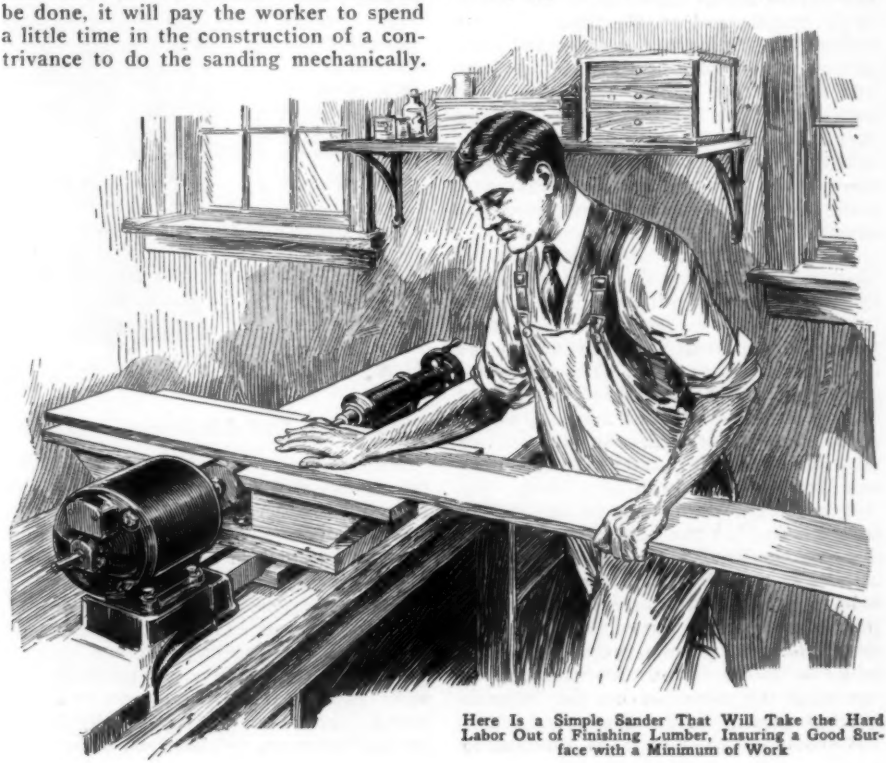
All Shop Notes published in 1928, in book form—Fifty Cents—from our Book Department

Sanding on the Lathe

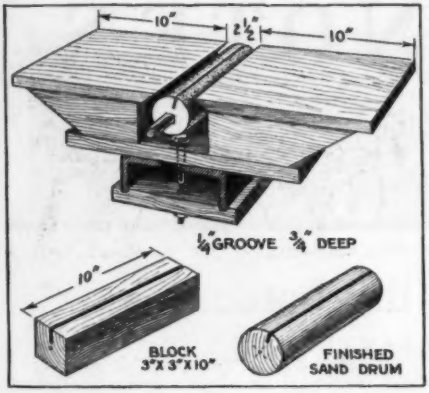
By W. CLYDE LAMMEY

MOST home craftsmen will agree that the sanding of their work, preparatory to finishing, is the most tedious part of the whole business, and, for that reason, it is often slighted, to the detriment of the finished job. Sanding rough stock especially demands the use of no little energy, and where there is much of this work to be done, it will pay the worker to spend a little time in the construction of a contrivance to do the sanding mechanically. This is easy if he has a small lathe in his home shop.

Obtain a piece of 3 by 3-in. stock, 10 in. long, and cut a groove, ¼ in. wide and 1 in. deep, down the center of one face, that is, 1½ in. from the edge. Center the piece in the lathe and turn it to form a drum, 2¾ in. in diameter. Be careful to



Here Is a Simple Sander That Will Take the Hard Labor Out of Finishing Lumber, Insuring a Good Surface with a Minimum of Work



have the drum of exactly the same diameter throughout its length. Any kind of stock will do for the drum, although good well-seasoned hardwood is preferable.

Next get a piece of 2 by 8-in. stock and cut from it a piece, 16 in. long. Draw a line square across the stock, in the center of its length, and on this line bore two holes for ¼-in. bolts. Cut another piece of stock of the same width, but 1 in. thick and about 2 in. longer than the width across the lathe ways. Cut two grooves across the face of this piece, so that they will fit over the underside of the lathe ways, as shown in the drawings, and, using the first piece as a template, drill two holes for ¼-in. bolts.

The height of the table shown in the illustrations is 5⅞ in., from the top of the lathe bed to the top of the table. This is for a lathe of 8-in. swing, but of course this dimension must be determined by the lathe the sander is to fit. The tables are made of 1-in. stock, well dried, and should be at least 8 in. wide, and better 10 in., to afford a good bearing for the work. They must be planed to a true surface and mounted rigidly on the 2-in. base. Use screws and glue (not nails) in assembling, and be sure that the height of the drum carrying the sandpaper will not be more than 1/16 in. above the surface of the tables. Also be sure that the surfaces of the tables are not thrown out of true in assembling. Bevel the ends of the tables that go next to the drum. The method of mounting the assembly on the lathe is apparent from the drawings.

A sheet of garnet paper is attached to the drum by cutting to size and folding the edges into the groove, afterward driving short wedges into the groove on the ends and cutting them off flush with the surface of the drum, so that they do not strike the work.

It will be found that this sander is a great improvement over the hand method, the high speed of the lathe leaving the work smooth and without objectionable scratches. It also leaves a true surface, if the work of constructing the sander has been done with reasonable care.

Swab for Applying Acids

An easily made swab for applying acids and other substances, which must not come in contact with the fingers, is shown in the photo. Simply remove the contents from an old flashlight dry cell, fold a piece of burlap or heavy cloth into a flat strip and pinch the opening of the cell tightly over it. The zinc is worked easily with the fingers, and it holds the cloth or swab firmly. The remainder of the cell provides a convenient grip for the swab.—F. W. Bentley, Jr., Missouri Valley, Iowa.

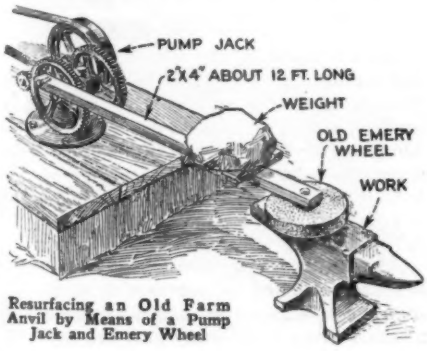
Parts of Car That Are Seldom Lubricated

Many automobile owners are under the impression that every part of the car has been oiled or greased sufficiently at some time or other. However, this is far from true, and there are usually a number of places that are seldom lubricated even though they need it badly. Insufficient lubrication often is the cause of expensive repairs. The grease cups that are hard to get at are neglected even by many garage attendants, so the owner ought to know where they are. They are usually found in inconspicuous locations as, for exam-

ple, the two cups that oil the outer rear-axle shaft and the roller bearings. These are located on the rear-axle housing, near each end and close to the brakes. It is more important that they be given attention than the spring hangers, but in spite of this, only a few auto owners know of their existence. These cups should be filled once a month. The efficiency of the brakes depends to some extent on how well the brake mechanism is lubricated. One brake pin may "freeze" for lack of oil, and this will throw the entire mechanism out of proper adjustment. Once a month it should be oiled, from the pedal to the brake shoes, with penetrating oil. Another often neglected part is the universal joint. Of course, nearly everyone knows it's there but it is nevertheless frequently overlooked. A few drops of oil on the generator is necessary now and then and clutch bearings should not be forgotten.

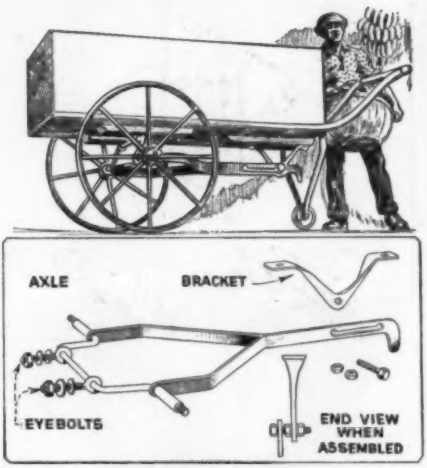
Resurfacing Farm Anvil

An old farm anvil can be resurfaced with very little work by using the rig shown in the illustration, which consists of a grindstone or emery wheel driven back and forth over the anvil surface by means of a pump jack run by a small engine. A 12-ft. length of 2 by 4-in. stock is used as a connecting rod between the pump jack and the emery wheel, and a suitable weight is tied or otherwise fastened to the top of the connecting rod, near the emery wheel, as indicated. In some cases, it may be found necessary to provide guides for the connecting rod so that the emery wheel will not slip off.



Resurfacing an Old Farm Anvil by Means of a Pump Jack and Emery Wheel

Load-Balancing Pushcart



Heavily Loaded Cart Can Be Better Balanced by Shifting the Axle

Loaded pushcarts are often improperly balanced so that, when the greatest weight is on the front end, the cart will have a tendency to tip over in this direction, and when the most weight is on the back, the person pushing the cart must practically lift the load besides pushing it, which is very tiresome. To overcome this trouble, I arranged the axle so that it could be moved either forward or backward to balance the load. The axle was bent to a U-shape and was securely attached to the underside of the cart by means of eyebolts. A Y-shaped brace, made from flat iron, was fitted on the ends of the axle, holes being drilled in the ends of the brace for this purpose. A slot with two notches was cut in the single end of the brace to accommodate a bolt, with which it was held to a flat-iron bracket attached to the underside of the cart near the handle. The bolt is fastened securely to the bracket by means of two nuts, and the slot in the Y-brace slips on the shank of the bolt, but cannot come off as it is held between the head of the bolt and one of the nuts. The end of the Y-brace is bent down at right angles to form a handle, permitting the worker to shift the brace and wheels back and forth as desired. The body of the cart is held quite firmly in either position.—S. E. Schofield, Indianapolis, Ind.

Simple Hitch Permits Worker to Lower Himself at Will on Boatswain's Chair

Rigging Boatswain's Chair

To rig a chair for lowering or raising yourself, hook a single block on the roof, wall or structure on which you are going to work, and with a gantline rove through it, make the chair fast as shown in the upper left-hand detail. Get in the chair and have someone pull you up to the top. Then take a small length of rope or strong marline and lash the two parts together, being careful to have the lashing secure so that it will not slip. The man below can then let go of the end so that you can pull up some slack. Then take hold of the bight of the rope and pull it toward you through the bridle of the chair as in the upper right-hand detail. Slip the bight over your head, around your body and the chair, and draw it up as shown in the center drawing. You can now let go of the lashing and you are all set to lower yourself at will. This is done by taking hold of the rope and pushing it through the loop. It cannot slip or get away from you.—C. Newkirk, Chicago, Ill.

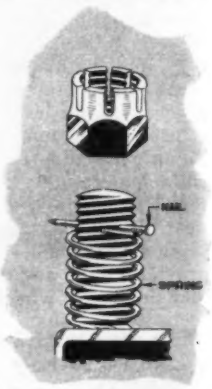
A length of garden hose, split and slipped over the teeth of a saw that is being filed, is a handy arm protection.

Reducing Speed of Lathe

Here is a novel method of reducing the speed of a small metal-cutting lathe: Get an old-type auto-starting motor equipped with a sprocket, of the kind used on many models prior to 1919. These motors have a reduction gear, which in case of a Wagner motor is 1 to 10. Remove the core and commutator from the shaft so that the case serves merely as a housing for the shaft and the gears. A small grooved pulley, suitable for a ¼-in. round belt, is securely fastened to the shaft. A length of belting is run from this pulley to a similar grooved pulley on the motor that drives the lathe. A bicycle sprocket is attached to the driving pulley on the lathe and in line with the sprocket on the starting motor, the two being connected with a bicycle driving chain. I have reduced the speed from 1,750 to 50 r.p.m. in this way.—Sidney Cornell, New York City.

Compressing Heavy Springs

When assembling rather stout or heavy springs, as, for example, the spring retainers for truck radiators, the method illustrated will prove advantageous. A wire nail is placed through the cotter-pin hole in the end of the stud and the spring is screwed down on this, thus gradually compressing the spring. When the spring has been screwed down far enough, the washer and nut are slipped on a few threads, and the nail withdrawn. This method will save 10 to 15 minutes of fumbling and prying down on the spring, while trying to engage the thread of the nut.



Annealing Small Sheets of Aluminum

After a small sheet of aluminum has become hardened by hammering or swaging, it can be softened again by smearing a thin coating of ordinary vaseline on both

sides and holding the sheet over a Bunsen-burner or gas-plate flame. The surface becomes black at first. By continuing the heating while moving the sheet back and forth, it will suddenly turn to its natural color. When this happens, the sheet must be removed immediately and left to cool in the air. Do not cool it under water. —L. L. Llewellyn, Piedmont, Calif.

Adjustable Horses Found Convenient

A number of adjustable horses of the kind shown in the photo are used in a Denver machine shop for supporting broad material at the different machines. The horses are made mostly of wood. They are 4 ft. long and 30 in. high at the lowest adjustment. The 6 by 6-in. main part of the horse is braced to the legs with strap iron and reinforced with a ¼-in. steel plate on top and bottom. A 2-in. square bar of steel, with ¾-in. holes ½ in. apart, passes perpendicularly through the body, near each end. The top ends of the bars are split and forged to fit grooves turned in a 2-in. steel roller, which supports the material. A rod, passed through the holes in the vertical bars, holds the roller at any desired height.

Horse with Roller of Adjustable Height Found Useful in Machine Shop

Two Views of a Large-Size Photograph Printer Which Is Equipped with Exhaust Fan, Vacuum Pump and a Number of Switches

Large-Size Electric Printer for the Photographer

Ordinary photographic printers will only take negatives up to 11 by 14 in. in size. To make prints 20 by 24 in., and larger, one firm found it necessary to build a special printer. The photo clearly shows the construction and the arrangement of the lamps and snap switches, one switch being used for every three lamps, to enable accurate control of illumination. Altogether there are sixty-three 60-watt lamps and two red lamps for placing the paper in position. This printer will take negatives up to 30 by 40 in. in size. After the negative is placed in position and the printing paper laid on it, the rubber blanket is clamped in place and, by starting the vacuum pump, with which this printer is equipped, all the air between the pressure glass, negative and paper is removed, insuring absolute contact over the entire surface of the print. Another feature is an exhaust fan on the left side to remove the hot air from the inside.

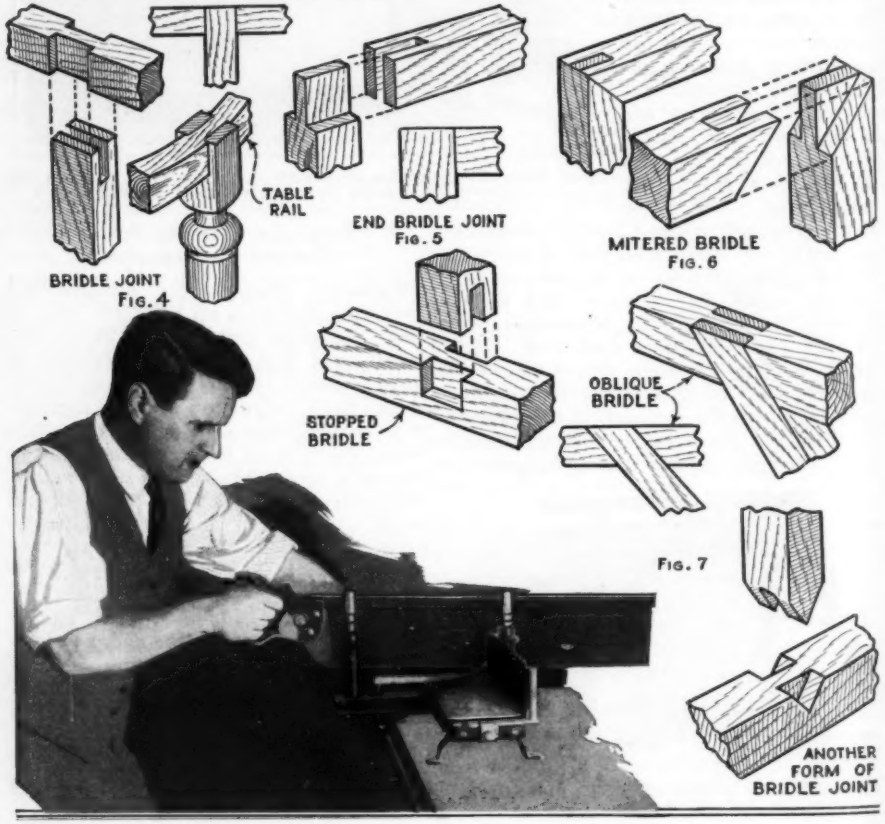
Wood Joints for the Amateur

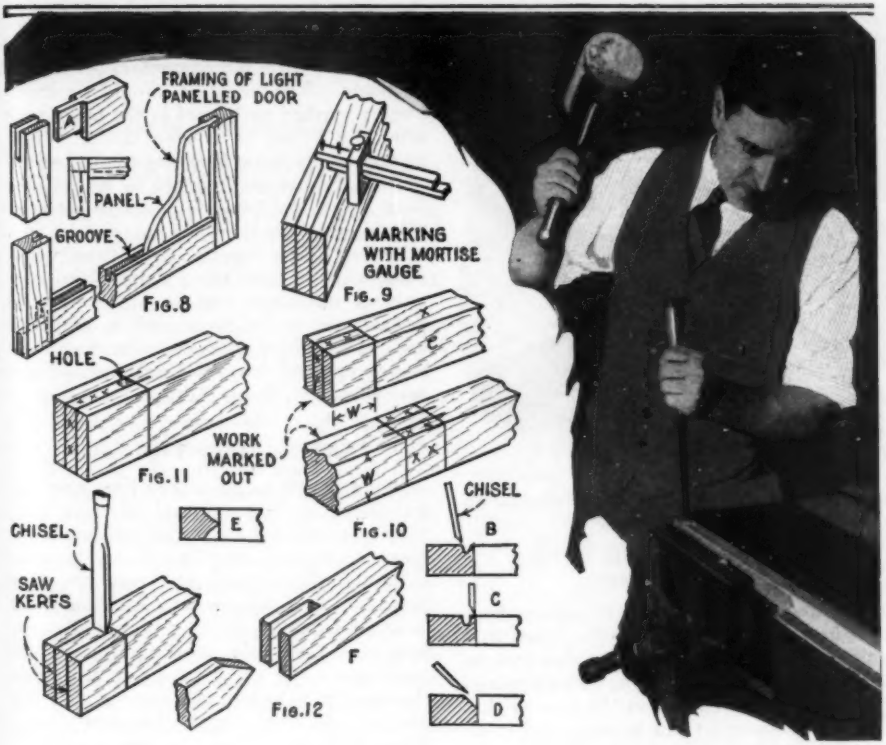
PART III

THE BRIDLE joint (Fig. 4) is a very handy joint for the amateur, since it is a little less difficult to make than the mortise-and-tenon joint. Its usefulness is not as wide as that of the latter and lies more in carpentry and joinery than in cabinetmaking. However, for light frames for small doors, window and draft screens, etc., it is quite satisfactory, and also for the center legs of small semi-circular tables, as indicated.

The end bridle joint of Fig. 5 is common for frames, and is known also as an open-slot mortise and tenon. The mitered bridle (Fig. 6) looks a little more difficult, but is really simple to make. The parts must be carefully laid out with square, bevel gauge and knife. Then the vertical cuts forming the tongue are made, holding the work at an angle in the vise and cutting down to the line defining the length of the tongue. The shoulders are then cut in the miter box. The cutting of the mouth will be described later, in connection with the end bridle. The joints in Fig. 7 are used mostly in heavier work, although the oblique bridle finds occasional employ in cabinetmaking.

When making up a frame for a light paneled door, as in Fig. 8, note that the bottom of the groove for the panel on the inside edges of the rails is even with the inner edge of the tenon A, thus making the groove easy to plow. The grooves





on the inside of the stiles run into the slots at the ends, so there is no difficulty in plowing them.

When making a bridle joint, the thickness of the stock is usually laid out into thirds. Set a mortise gauge to the size, and gauge the edges and ends as in Fig. 9, which shows how both pieces are laid out for an end bridle, or how the leg in Fig. 4 is marked out. Fig. 10 shows the two pieces laid out, and it will be seen that the length of the slot in the leg, W, is the same as the width of the rail. After laying out, mark the waste, or stock to be cut away. The waste on the rail is cut away exactly as described for making a half-lap joint (Fig. 2, March issue).

To cut out the waste in the slot, drill a hole, about 1/16 in. less in diameter than the width of the slot, as shown in Fig. 11, taking care to keep the hole vertical and square with the face edge; saw along the lines to release the waste, and pare the bottom of the slot square.

An alternative method is to make the kerfs first, sawing just inside the line, and down to the line for the bottom of the slot. Then, using a chisel the exact width the slot is to be and setting it, with the bevel toward the bottom of the slot, about 3/16 in. away from the line (see left-hand sketch, Fig. 12), drive the chisel in about 1/2 in.; withdraw and move it back about 1/2 in., with the bevel facing outward and drive it in as at B, so as to take out a triangular chip. Set the edge of the chisel exactly on the line for the bottom of the slot, with the bevel toward the outer end, and drive it straight down, as at C. Move the chisel outward again, and take another chip as at D. This will bring the cut down to about the center of the stock. Now turn the stock over and repeat the process on the other side, so that the stock will appear as in the section at E, and the waste will drop out as at F. If the cutting has been carefully done, no further work is necessary.

Box with Shelves and Partitions, Locked Door and Air Holes, Protects Grain Bags

Box for Fanning-Mill Screens and Grain Bags

Fanning-mill screens and grain bags can be kept out of the reach of rats and mice by storing them in a wooden box, as shown in the illustration. Shelves and partitions are provided in the box so that the stored material can be arranged in an orderly manner, and large holes are cut in the ends to provide adequate ventilation, the holes being covered with wire mesh tacked down securely on the inside to prevent the entrance of rodents. Care should be taken to have the door or cover fit snugly and a hasp and padlock may be provided. Periodical examination of the box is recommended so that, if rodents have gnawed a hole in it, prompt repair can be made.—J. R. Koontz, Bremen, Ind.

Prints from Wet Negatives

Nearly every photographer realizes that certain pictures, especially those for newspaper publication, must be finished quickly in order not to lose their news value. To make contact prints from wet negatives, a saturated solution of potassium carbonate is prepared. After the negatives have been washed they should be wiped off carefully with a soft cloth or a piece of chamois skin, and placed in the potassium-carbonate bath for a few moments, after which they are again wiped dry. The potassium carbonate provides a dry surface from which contact prints can be made. The negative should be thoroughly washed and dried in the usual way after the prints have been made. When enlargements from wet negatives are required, the negative should be rinsed free from hypo and placed in a five-per-cent solution of formaldehyde for one or two minutes. The negative will then withstand the heat of the enlarger and any number of copies can be made. If the negative is to be preserved, it must be washed and dried in the regular way after being removed from the enlarger.—Jesse A. Leason, St. Paul, Minn.

Kink for Using Tape Line

Often, when using a tape line, one has no helper around to hold the eye end, which is particularly inconvenient when measuring from one point to another without any surface to press the line against. This trouble can be eliminated in many cases by opening the middle section of a 2-ft. rule, catching the eye of the line on the small wire pin, and then closing the halves of the rule so that the eye will be held firmly between them. When making vertical measurements the rule can be laid down and one foot put on it while drawing the tape taut. If the measuring is to be done on the ground, the rule can be pushed down into the soil.

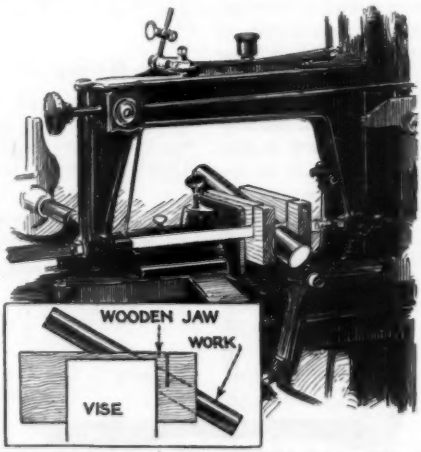
Preventing Marks on Work in Lathe

When running a piece of finished work in a lathe steady rest, it is common practice to place a piece of soft metal over the end of the jaws in order to prevent them from scratching the work. A better and more up-to-date method is to make an

extra set of jaws out of bakelite or similar material. They are very strong and will not scratch the work.

Clearance of Milling Cutters

In grinding the clearance on the cutting edge of milling cutters, sufficient attention is usually not paid to the angle or exact amount of clearance the cutter will have on the work. If too great, the cutter will have a tendency to chatter and make a rough finish, to say nothing of the disagreeable noise, and the loosening up of the bolts and clamps on the machine will cause the heel of the land to drag, making an uneven surface, and is liable to break the teeth. The angle depends, to a great extent, on the diameter of the cutter and also on the material it is to cut, although, in general, milling cutters are used on almost anything that can be cut, from a piece of hard wood to high-carbon tool-steel, making regular shapes, such as plain, slabbing, slanting, or angular, while in those that are made up for a special job and used for that purpose only, more attention must be given to the kind of material to be cut. Generally soft materials will machine better with more clearance than tool steels, and the like, although conditions may cause the reverse to happen. Usually, for cutters up to 4 in. in diameter, from 6 to 7 deg. will be found ample on the outside diameter. Over and above this diameter, the angle may decrease, say, ¼ deg. for each 1 in. in diameter, until 4 deg. is reached, which is about the minimum amount for any cutter. The clearance on the teeth of end mills should be from 2 to 3 deg., when the cutters are used for roughing and finishing. If used for roughing alone, a little more clearance will be better. —A. Dane, Pottstown, Pa.



Using Wood Jaws for Sawing Metal Rod and Tubing at an Angle

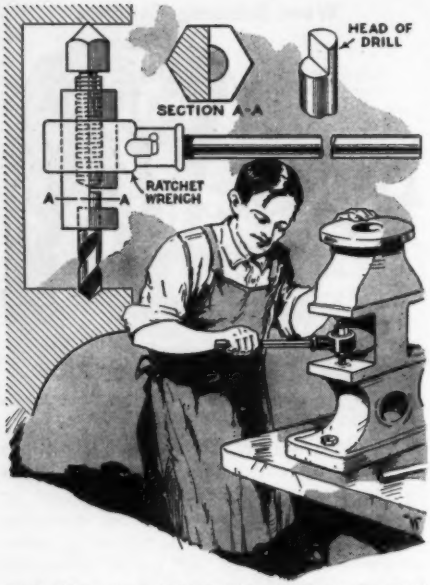
When Breaking Concrete

Using an Old Broom to Hold the Chisel When Breaking Concrete

An old broom will come in handy when breaking up concrete. Use it as shown in the drawing to hold the bull point or chisel, and to prevent bits of concrete from flying up. When using a compressed-air hammer, or power concrete breaker, slip a piece of screen, about 1 ft. square, over the point of the drill. This will enable the operator to see the work through the screen without danger from flying bits of concrete.

Sawing Metal Rod at an Angle

To saw lengths of tubing or metal rod at an angle on the power saw, I use a couple of pieces of wood as auxiliary vise jaws. By allowing these to extend a little beyond the cut as indicated, I have found the work can be sawed at any angle just as easily as straight. The saw, of course, cuts through the wood jaws before striking the work, so that, by the time it reaches the cut, it is well guided. Scrap pieces of wood are usually to be found around any machine shop. —Harry Moore, Montreal, Can.



Tool Driven by a Ratchet Wrench, Handy for Drilling in Confined Places

Simple Tool for Close Drilling

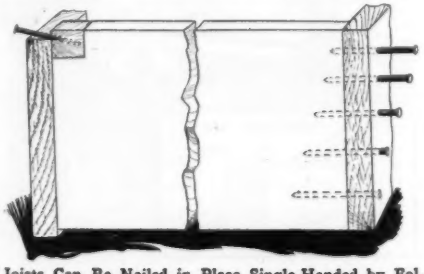
For drilling in close places, a small ratchet drill is often found too large. A more compact tool is necessary where the flanges of the castings or the webs of channels are spaced 3 or 4 in. apart. One of the handiest devices for use on such jobs consists of a suitable length of hexagon bar stock, a setscrew and a ratchet wrench. A hole is drilled in one end of the bar to accommodate the drill, and the other end is drilled and tapped for a setscrew, the head of which is ground to a point. The drill is ground down, half of the head being removed as shown in the upper-right detail. This allows it to be securely locked so that it will not turn. The ratchet wrench is then slipped over the body of the tool, and by manipulating this, the hexagon part will be turned and the screw will be fed down into the work.—G. A. Luers, Washington, D. C.

Strong, Durable Plaster-of-Paris Mixtures

Fifteen years ago, I set ¼-in. bolts, attached to a sundial triangle, into ⅝-in. holes, 3 in. deep, in a stone base on the grounds of the Ontario hospital, at West Toronto, Can. The cement I used was made of 4 oz. of plaster of paris, 4 oz. of portland cement, and ½ oz. of dark brown sugar. The ingredients were well mixed, and just enough water was added to make the whole fairly stiff. This cement has been exposed to the weather at all times, and the bolts are as firmly set in it as they were 15 years ago. The same mixture is often used by heating engineers to cement together the joints on 4-in. cast-iron pipe, sometimes used in greenhouse heating. It sets very hard and is waterproof and easy to work. The addition of a small quantity of fine sand will make a stronger and perhaps harder cement. To keep plaster of paris soft for slow working, mix wheat flour in it, in the proportion of ¼ oz. of flour to every 5 oz. of plaster. Using a greater amount of flour will retard the drying of the cement still more. If asbestos powder is used in plaster of paris to make it tough, it should be very carefully sifted through an extra-fine sifter before using it. Coarse asbestos powder will prevent the cement from setting so strongly as when finer powder is used. All combinations of plaster of paris and other powders should be thoroughly mixed before adding any liquid.—James E. Noble, Toronto, Can.

Nailing Joists Single-Handed

One man can handle a joist single-handed and nail it in place at both ends by the method shown in the illustration. Drive a nail partly in at one end near the top of the joist and hook the nail over the sill to hold the joist in place temporarily until the other end has been nailed securely. Then remove the first nail and proceed to nail this end also.—H. H. Siegele, Emporia, Kansas.



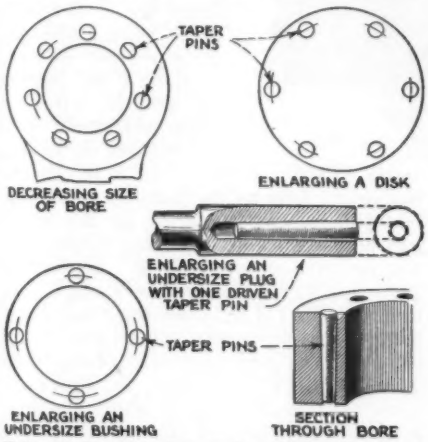
Joists Can Be Nailed in Place Single-Handed by Following This Method

Kink for the Planer Bed

While watching a worker setting up a job on the planer bed one day, I noticed that he had his clamps resting on several sloping surfaces. Wondering how he was able to keep the clamps from slipping off, I investigated and found that he had placed short pieces of old files between the end of the clamp and the metal incline, making the surface non-slipping.—Frank N. Coakley, Buffalo, N. Y.

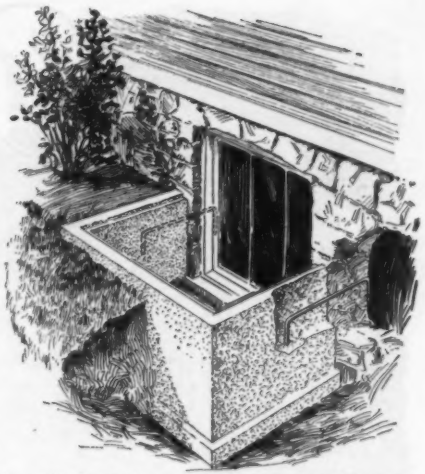
Expanding and Contracting Circular Machine Parts

Circular machine parts are sometimes machined slightly over or undersize. In the latter case, the part is sometimes plated to restore it to the desired diameter, but, in many small shops not having plating equipment, simpler expedients must be used. A method of expanding and contracting circular parts, which, while not highly accurate, will serve in many cases, consists in driving a taper pin into reamed holes drilled near the edge of the work as shown in the drawing. The examples illustrate the method of decreasing the size of the bore and enlarging an undersize bushing, plug or disk. The material to be altered must be moderately soft, so that it will yield to the pressure applied



Drill and Taper-Pin Reamer Are Used to Expand or Contract Machine Parts

with a comparatively hard taper pin. The only tools necessary for this work are the usual drill and taper-pin reamer.



Iron Hooks Used to Anchor Concrete Window Box Securely to Basement Wall

Window Boxes Anchored to Cellar Wall

Many houses built nowadays have the first floor only a short distance above the ground level, which makes it necessary to box in the basement windows. The boxes are usually made of concrete and, in many cases, they gradually pull away from the wall and allow leakage. To prevent this, one contractor anchored them securely to the wall by means of two iron hooks, as indicated in the drawing, the hooks being imbedded in the concrete when this is poured. If the basement wall is built of stone or concrete blocks, the anchors are slipped between the stones or blocks when the latter are laid, and then imbedded in the window box. It has been found practically impossible for the boxes to pull away from the wall when anchored in this way.

Easy Method of Sandpapering Auto

When I started the job of repainting my auto, I knew that a lot of sandpaper and muscle was necessary. I drove the car down to the beach, and by using plenty of sand and water with a piece of heavy felt, I removed most of the paint. By using a fine grade of sandpaper in going over it a second time for finishing touches, the job came out very smooth, at a considerable saving in effort and sandpaper.—Charles Latour, Jr., Plattsburg, N. Y.

Making a

PART II

FIGURES 5 and 6 detail the upper section. While complicated in the assembly, the individual parts are comparatively simple. The back is 2 ft. 2¾ in. by 3 ft. 4¾ in. From the right upper corner a piece, 7¾ by 11¾ in., is cut, and for a distance of 5 in. above the horizontal part a strip ¼ in. wide is cut. Mark for this cut and saw obliquely toward it, springing the blade out, and cutting in with the line as quickly as possible. Then saw in the opposite direction to finish the cut. This notch receives the rabbeted end of a sidepiece. The upper left corner is cut out 8 in. by 1 ft. 10 in., the vertical cut then being notched ¼ by 6¼ in. at the bottom and ¼ by 7½ in. at the top. Rabbet the lower end ¼ by ¾ in. for 8¼ in. from the left, and 8 in. from the right.

The long right side (center piece marked A in Fig. 6) is 16¾ in. by 34 in. Rip ¾ in. off the back, extending from the lower end to within 4¾ in. of the top. Cut a 7¾ by 8-in. piece from the lower back corner, and rabbet it ¼ by ¾ in. Then, from the front upper corner, take a piece 7¼ by 9 in. A ¼ by ¾-in. dado is cut full width of the inner face, 12¼ in. from the lower end, and a second one, 2¾ in. above it. A third is made 7 in. farther up, that is, with the upper side flush with the bottom of the big notch. This is deepened to ½ in. on the horizontal part of the notch, and this ½ by ¾-in. rabbet is carried up the notch and across the top. The left rabbet corner is notched ¾ by ¾ in. A vertical dado, running from the lower end to the first dado, is 7¼ in. from the front edge. Rabbet the projecting lower end ¼ by ¾ in. On the outer face two dadoes, ¼ by ¾ by 8¾ in., are cut, one 7 in. above the lower end, the other 8¾ in. above the first. A third, full width of the narrow upper end, is 10½ in. above the second.

The long left side (left-hand piece A, Fig. 6) is 1 ft. 4¾ in. by 3 ft. 5 in. The inner-face dadoes correspond to those of the other side, as does the lower rabbet

Modern Bookcase

by

E.M. Love

and notch. A fourth horizontal dado corresponds to the upper rabbet of the other side. The upper end is rabbeted ½ by ¾ in. Between the two upper dadoes cut out a rectangle, 8¾ in. wide, and rabbet all around this ½ by ¾ in. Cut a ¾-in. strip off the back edge from the bottom to a point 1 ft. 6½ in. above, and rabbet the rest ½ by ¾ in. A ¼ by ¾-in. dado extends from the upper horizontal dado to the top rabbet, as in Fig. 6. Two dadoes, ¼ by ¾ by 7¼ in., on the outside at the back, one 7½ in. above the lower end, the other 9¼ in. above it, carry the small side shelves.

Make the top (A in Fig. 5) 10¾ by 16¾ in. Rabbet the back edge on the underside ½ by ¾ in., and saw a strip off the right side, ¼ in. wide, for a distance of 8 in. from the front. The shelf below (K) is 10½ in. by 1 ft. 3¾ in., with a ¼-in. strip off the left side, 7¾ in. long. The next shelf down is the same, except that a ¼-in. strip, 8 in. long, is removed from the right edge, starting from the back. The following two shelves are 10½ in. by 1 ft. 4 in. The bottom shelf is L-shaped, 18¼ in. wide at the back, 1 ft. 4 in. from the front to the back, and 10 in. wide in front. It fits both the middle and the right compartments.

The three partitions are next made. The upper one, between the top and the first shelf down, is 6½ in. high and 10¾ in. wide. The middle one, just below it, is 8¼ in. high and 10¾ in. wide. The one below this is 8¼ in. high and 10½ in. wide, while the lowest is 12½ by 10½ in.

At this stage it is well to assemble the parts so far as they are made, not only because it makes clearer the arrangement of the other pieces, but also because any small errors may be compensated for in making the rest. Assemble the sides with the shelves and partitions, nailing the butted upper and lower edges of the partitions, and add the back.

The top of the right wing, 8 by 9½ in., is rabbeted ½ by ¾ in. on the underside

at the back. The front section fitting with it is 7¾ by 12 in., rabbeted at the upper and lower edges. It makes a butt joint with the long side, while the top piece fits into a dado. The shelf below is 7¾ by 8½ in., and the sidepiece fitting against it is 9½ by 8¾ in., rabbeted ½ by ¾ in. at the top and bottom. In addition, the front edge is notched back ¼ in. to fit into the rabbets of the front pieces. The next shelf is also 7¾ by 8½ in., and the lower front part is 7¾ by 8½ in., rabbeted ½ by ¾ in. at the top and ¼ by ¾ in. at the bottom.

The top of the left wing, detailed in Fig. 6, is 8¼ by 8 in., and rabbeted ½ by ¾ in. at the back. The middle shelf is 8 by 7¼ in., and the lower is 8¼ by 7¼ in. The side is 8 by 19 in., with the upper end and back rabbeted ½ by ¾ in., and the lower end ¼ by ¾ in. A ¼ by ¾-in. dado across the inner face, 10 in. from the lower end, supports the middle shelf.

When assembled, plane off all projecting ends and scrape uneven inside places. A ¼-in. strip of wood is glued into the open joint inside the right lower compartment.

It is difficult to hide the plies of the edges with paint, even though they are well sandpapered. The writer has found gesso to be the most satisfactory preparation for filling the plies. Smear on thickly, working well into the pores, and

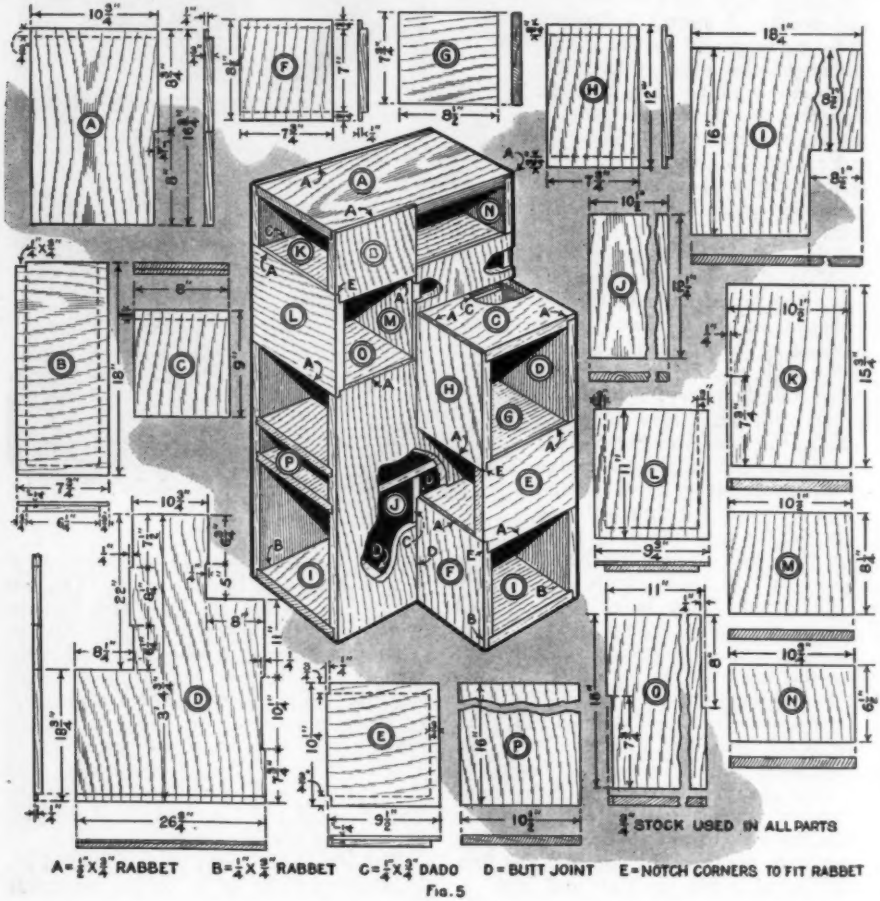


Fig. 5

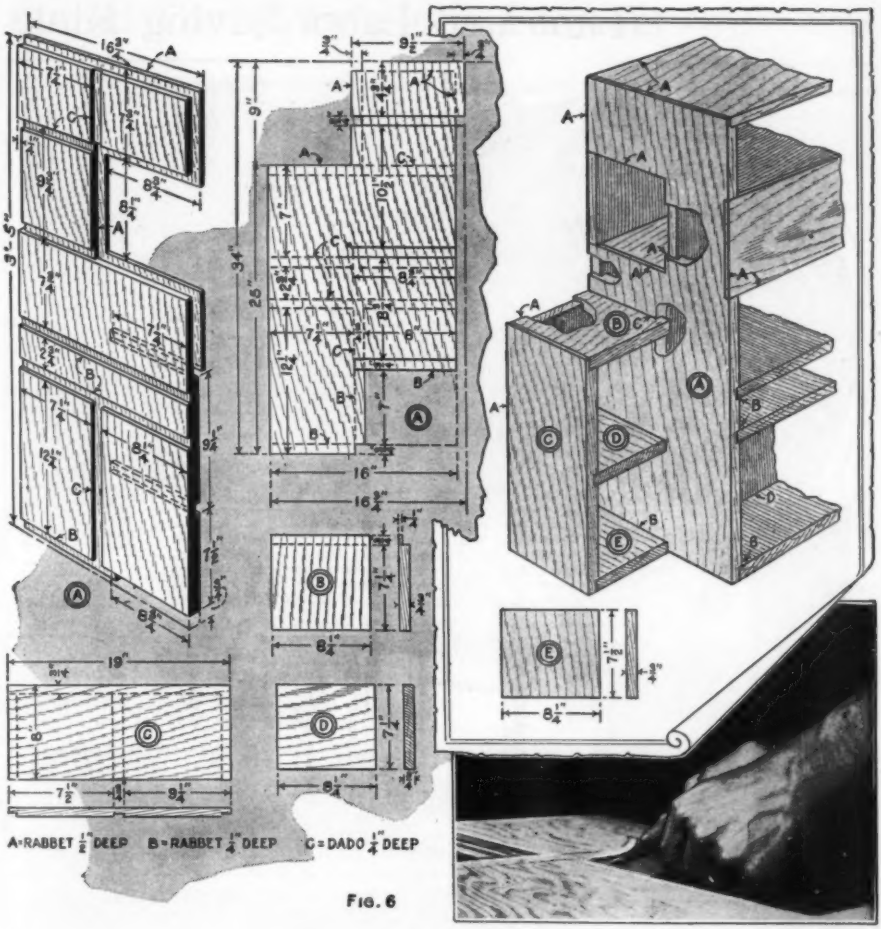


FIG. 6

then rub off reasonably smooth with a putty knife. Allow it to dry for a day or so. Then carefully trim off lumps with a sharp chisel, smooth with No. ½ sandpaper, used on a flat block, and finish with fine grit.

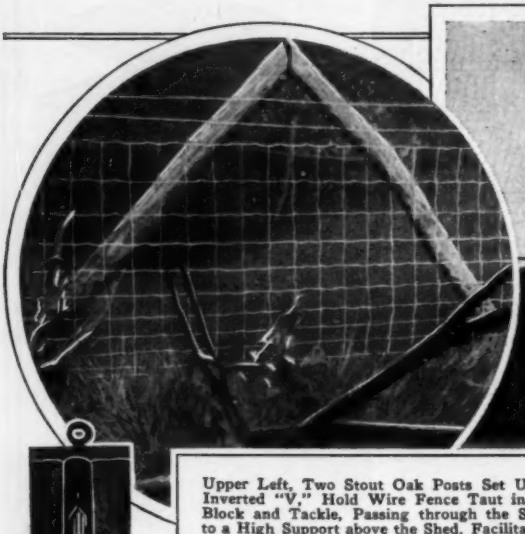
Any open joints can also be filled with gesso; in fact, a pretty sorry-looking job of cabinetmaking can be made into a reasonably good surface for painting, and if the reader has bad luck with the bookcase, either in the way of open joints or splintered veneer, he will do well to try filling the defects in this way before abandoning the project.

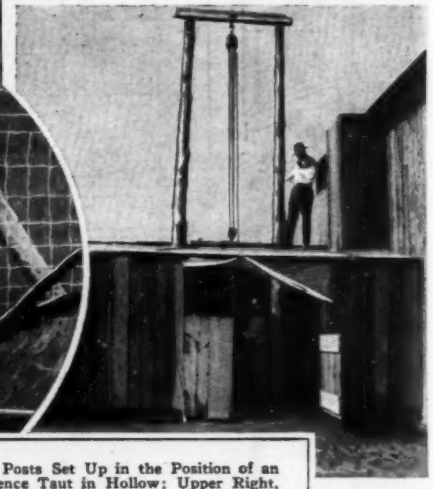
Sand off all corners to a radius of about 1/16 in. Give three or four coats of flat paint, all well sanded, before applying enamel. The case in the photograph was painted sage-green, and striped on the sides of the top nosing and the top of the heavy base member with orange. The tops of the steps of the nosing, and of the narrow member of the base, were made lavender.

Secure the top to the lower section with small iron strips on the back and a screw through the lower-section top into the bottom shelf of the upper section.

¶A piece of rosin stirred into melted babbitt will make it run better.

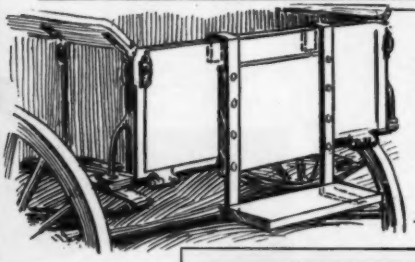
Time and Labor-Saving Kinks



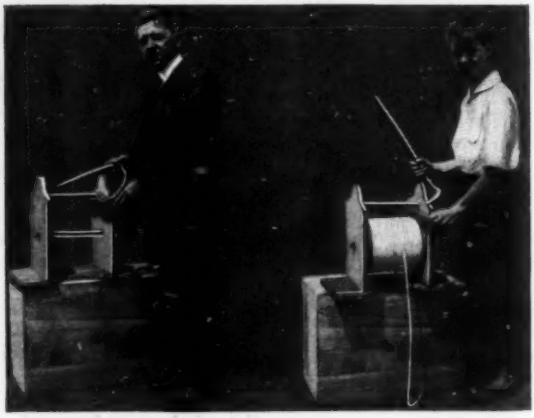


Upper Left, Two Stout Oak Posts Set Up in the Position of an Inverted "V," Hold Wire Fence Taut in Hollow; Upper Right, Block and Tackle, Passing through the Shed Roof and Attached to a High Support above the Shed, Facilitates Butchering of Large Animals, Which Are Hoisted with a Team of Horses

The Dairy Thermometer Can Be Protected against Breakage When Stored Away by Slipping It through Screweyes Located in a Groove Cut in a Piece of Log, the End of the Groove Forming a Support for the Instrument



Wagon Step Made from Pieces of 1-In. Wood, Bolted or Screwed Securely to Two Lengths of Flat Iron, Which Are Bent to the Shape Shown, Is Hooked onto the End Gate of a Wagon; It Has Been Found Especially Convenient for Huckstering and for Delivery Purposes; Being Removable, It Can Be Put Away When Not in Use



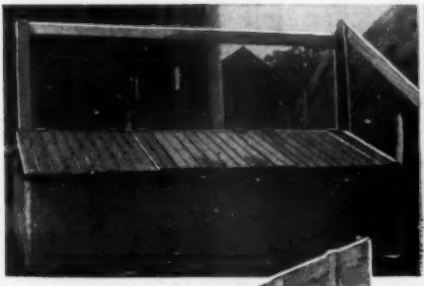
Device for Holding a Cordeau Spool While Loading Well Drill Holes; a Wooden Brake Is Provided to Stop the Revolving Spool, a Pointed Stick Being Used to Hold the Brake Down and Also to Punch Holes in Dynamite Cartridges

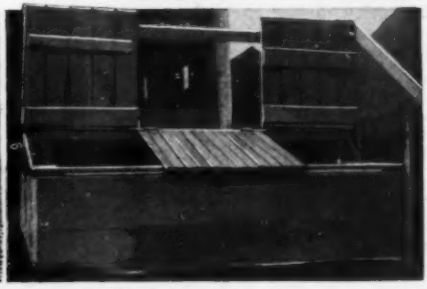
Found Useful by Keen Farmers

Wedges for Splitting Timber Are Always Handy in This Carrier

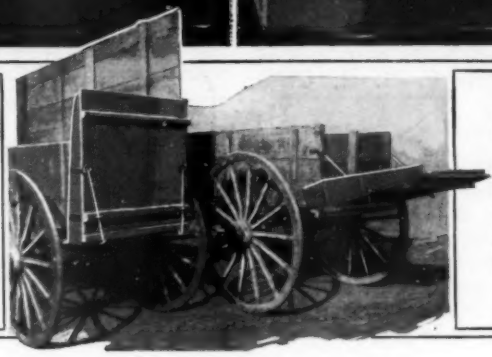
Handy Hitch Permits Quick Detachment, the Rope Being Slipped through an S-Shaped Iron Rod Welded Together

Above, Adjustable Roofs for Haystacks Used by Some Maryland Farmers; Left, Hay Protected by Layer of Corn Stalks; Right, Light Shed Built over Haystack





To Help Prevent Water in the Stock Tank from Freezing, Provide a Hinged Cover of 1-In. Wood; the Cover Should Be Sectional, Which Makes It Much Easier to Handle Than if It Is Built as a Single Large Piece



Wagon End Gate, Called a "Shoveling Board," Saves Labor When Unloading Corn with a Shovel, as the Work of Hoisting the Corn over the Gate Is Entirely Eliminated

Burning Gasoline on Putty Softens It, Thus Facilitating Its Removal

Fire Softens Putty on Sash

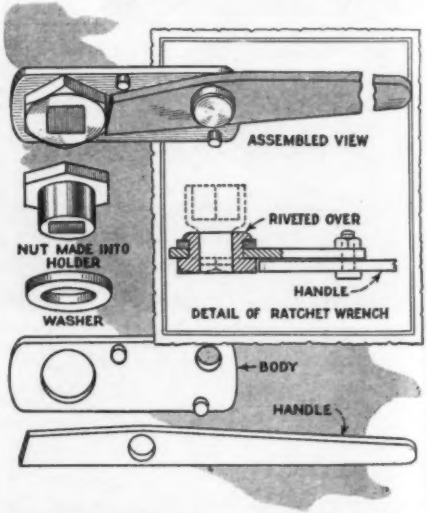
Here is a simple idea that greatly facilitates the job of removing old putty from window sash of which the pane is to be renewed. Get a small oilcan, of the kind in which a light grade of oil is sold, and fill it with gasoline. The hole in the spout of such a can is so small that the stream of gas can readily be controlled. First remove the old glass, then place the sash on a flat bench or table and squirt gasoline on the putty, being careful not to let it run over the wood part of the frame. See that all the windows and doors of the room in which this is done are closed so that there will be no draft. Ignite the gas on the putty with a match. The air coming from all four sides will cause the flame to rise toward the center of the sash, and hence will not scorch the frame. The heat causes the putty to become brown, and if enough gas is used, one burning is usually sufficient to soften the putty so that it can be removed. Do not let the putty cool off, as cooling hardens it.—B. R. Glatts, Weiser, Idaho.

Making Plastic Filler for Wood

The home mechanic can make a good plastic wood for filling holes, cracks, etc., by mixing sawdust, sifted to the desired fineness, or wood flour if obtainable, with any transparent brushing lacquer. After mixing, the filler should be kept in an air-tight container to prevent it from hardening. However, if it should harden from exposure to air, it can be restored to working condition by adding more lacquer or lacquer thinner.—J. S. Hagans, Chicago, Ill.

Improvised Ratchet Wrench

With the aid of this improvised ratchet wrench, work can be assembled in a fraction of the time usually required. The wrench can be made by any machinist in an hour or so, and the details of construction are clearly shown in the drawing. The body is made of a piece of flat iron, drilled and equipped with pins at the points indicated. A handle, made of stock of the same thickness, is pivoted to the body by means of a screw. The nut holder is made from an ordinary hexagon nut, filed out square, and part of it is turned down on the outside to fit the hole drilled in the body loosely so that it can be turned easily. After the turned-down end of the nut is slipped through the hole in the body, a washer is placed on this end, which is then riveted over to hold both the nut and the washer in place. In the shop where this idea originated, each machinist has from two to five of these



Any Machinist Can Make This Simple Ratchet Wrench Which Saves Considerable Time

wrenches, varying in size to meet the needs of different jobs.

AT LAST A HOUSE IN IRISH STYLE

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Plan No. 4-S-40

Here Is Something New—a Tabloid Plan: Studio Living Room, Attached Garage; House Can Grow as Your Purse Permits

WHY NOT a house in Irish style? Sounds interesting, doesn't it? Logical, too. We've borrowed style features from the Spanish, Dutch, English, Italians, Swiss and adapted them to American houses. Why should we longer neglect the fine traditions of the Emerald Isle?

Those sturdy thatched-roof houses of old Erin are in many ways as picturesque as the rambling half-timber cottages of Merrie England or the adobe houses of sunny Spain, topped with colorful tile and built around a patio.

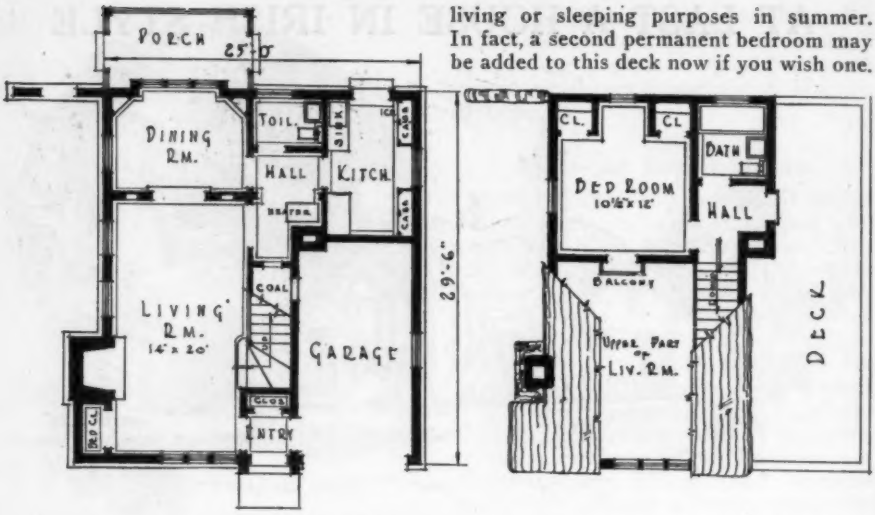
In the little house above, the designers have merged a bit of old-world tang with a dash of American daring and produced a touch of originality—perhaps just those features of style and service at low cost you've been looking for and haven't found as yet. Certainly there's romance and atmosphere here a plenty. But that's not all. Aside from something new, stylistically speaking, the little house offers you all the efficiency, comforts and conveniences of a roomy, yet reasonably small kitchenette apartment. In addition, the house may grow as your purse permits. In fact, you can make additions to the plan now if you wish.

The architects have given you a thatched roof with slight roll at the eaves, laid with variegated edge grain cedar shingles in brown and green; stucco exterior on metal lath with half-timber effect, reminiscent of old-world solid walls and plaster finish, and a rugged chimney of either fieldstone or brick, to add the external touch of solidity found in many an old Erin house. All of these features have been incorporated in a tabloid plan, and done so skillfully that you marvel at the roominess and spacious effects in so small a house. Garage and house are all under one roof and can be placed on a lot as narrow as thirty-five feet.

Let's look over the plan and equipment. There's a

HOW TO GET THE PLANS

To help our readers get started on one of life's most glorious experiences—building and owning a home—Popular Mechanics Magazine will supply readers a one-sheet blueprint of the house here illustrated for $2. This blueprint does away with the necessity of first purchasing a complete set of plans to find out whether you can afford to build. It contains floor plans, elevations, a section, detail, size of joists, studs, etc., and also a brief specification. Submit it to tradesmen and dealers for building estimates.



FIRST FLOOR PLAN

SECOND FLOOR PLAN

living or sleeping purposes in summer. In fact, a second permanent bedroom may be added to this deck now if you wish one.

studio-type living room with high ceiling and rafters exposed. A "Romeo and Juliet" balcony opens from the second-floor sleeping room and overlooks the living room below. An open stairway to the second floor is a feature. Next to the fireplace is a bed closet. This may be used for emergency purposes or, if the family is small, it may serve as permanent sleeping equipment. A toilet on the first floor, always a convenient feature, makes the first floor really quite a complete bungalow as far as equipment is concerned.

Notice that the dining-room floor level is raised one step above the living-room level. That's a touch of individuality. A porch may be built to the rear of the dining room. China cabinets flank a spacious window overlooking either garden or terrace. No doubt the full-mullioned window will prove a joy to housewives who appreciate the decorative possibilities of such a feature along with the flood of sunshine it provides.

The second-floor bedroom is planned for picturesque effects. A vanity alcove between the two closets will please the ladies. Opening from the upper hall, there is a door leading to the deck or roof of the garage. By stretching an awning over the deck, this space may be used for

This is a basementless house because it saves fifteen per cent on the cost. A basement may be had if you want one. Notice how the first-floor heater, placed in the rear hall, is served with fuel through a wall opening beneath the stairs. Fuel is stored off the garage under the stairs. The house is of frame construction and fully insulated. Interior finish may be of large surfaced insulation boards or wallboards treated with plastic paint or decorated to suit your taste. This means a saving over lath and plaster.

Summed up, you have in this little house every modern, practical space-saving feature along with a high degree of comfort and a large measure of style. You have it all at very reasonable cost. Recent Chicago estimates say $5,300 will build the house complete. Chicago prices range from ten to twenty-five per cent higher than prices in many other localities.

EDITOR'S NOTE: Popular Mechanics Magazine has prepared a home plan book, "Twenty Popular Low Cost Homes and Ten Commandments for Home Builders." These are selected homes and show labor, space and timesaving ideas. They are $5,000 homes and less. Send 10 cents in stamps to cover postage. Address Building Editor.

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